

NAVAL SHIPS' TECHNICAL MANUAL

CHAPTER 655

LAUNDRY AND DRY CLEANING



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CHAPTER 655

LAUNDRY AND DRY CLEANING

SECTION 1.

EQUIPMENT AND FACILITIES

655-1.1 REQUISITION OF EQUIPMENT

655-1.1.1 Procurement and installation of shipboard laundry and dry cleaning equipment must be selected from the equipment which is listed within the **Shipboard Laundry and Dry Cleaning Equipment Catalog (S6152–B1–CAT-010)**. Occasionally, other manufacturer's may be successful in providing equipment which meets the Navy's basic essential characteristics identified herein and will not appear in the catalog until the next revision. These and all other equipment are unauthorized unless it is specifically approved on a case by case basis by the Life Cycle Equipment Manager (LCEM). Any configuration change or alteration to a ship is prohibited as defined in OPNAVINST 4720.93 without approval from the Chief of Naval Operations (CNO) or the Naval Sea Systems Command (NAVSEA). Alterations to manned laundry or dry cleaning spaces or requests to redesignate the usage of existing spaces to self-service laundries must be accomplished using an approved K or D Ship Alteration (SHIPALT), Machinery Alteration (MACHALT), Alteration Equivalent to a Repair (AER), or Ship Alteration Repair Package (SARP). Approved alterations ensure correct installation, proper logistic support, documentation changes are made, all possible affected ships are identified, and that appropriate funding is set aside to accomplish the alteration. The installation of household type laundry equipment in manned laundry spaces, authorized self-service laundries or unauthorized spaces, such as sanitary spaces, wardrooms, pantries, FLAG/C.O. quarters, etc. is prohibited.

655-1.1.2 The equipment specified within the **Shipboard Laundry and Dry Cleaning Catalog** are designed to meet shipboard environmental effects, offer simplified operator to machine interface, meet shipboard safety requirements, and create an efficient means to meet the ship's laundry and dry cleaning needs.

655-1.1.3 The Navy's current laundry and dry cleaning equipment design philosophy is to keep the equipment design as simple as possible to minimize operator interface and maintenance requirements by selecting equipment which provides the basic operational functions as opposed to equipment which can perform a variety of unnecessary, specialized functions. Sectionalized equipment is also available which allows transportation of the equipment through shipboard passageways, doors, and hatches. Sectionalized pieces can then be assembled in the space using normal tools without the need for welding, cutting, or other types of hot work. This philosophy allows for the installation of equipment without the need for cutting costly access holes and paths to transport a fully assembled unit into the laundry or dry cleaning space. Sectionalized equipment also provides greater scheduling flexibility.

655-1.1.4 Details of the current equipment configurations, design specifications and features, including the essential characteristics of each category of equipment, will be defined in each equipment section. The equipment's essential characteristics identified herein reflect the Navy's current philosophy of utilizing commercial marine equipment by adopting commercial industry standards and discontinuing the past practice of procuring all laundry and dry cleaning equipment to the applicable military specification. Invoking military specifications in the procurement of laundry equipment is no longer required. However, all laundry and dry cleaning equipment procured for shipboard installation must meet the essential characteristics defined in this technical manual and future DOD adopted commercial specifications and standards. Any equipment which does not meet these require-

ments may degrade the efficiency of laundry and dry cleaning operations, reduce equipment reliability, compromise standardization efforts and create safety hazards. Any waiver to a specific essential characteristic must be approved by the Life Cycle Equipment Manager (LCEM). Efforts are underway to convert the existing laundry and dry cleaning equipment Military Specifications to Commercial Specifications such as the American Society for Testing and Materials (ASTM) at which time the Commercial Specification must be invoked during the procurement process.

655-1.1.5 Users of the **Shipboard Laundry and Dry Cleaning Equipment Catalog** are reminded that the U.S. Navy's supply system and procurement processes must abide by regulations established by the Federal Acquisition Regulations (FAR). The FAR requires that all stock system procurements be on a competitive basis. The items listed in the **Shipboard Laundry and Dry Cleaning Equipment Catalog** are products of manufacturers who are the current suppliers of approved laundry equipment at the date of the publication. Occasionally, other manufacturers, whose products do not appear in the current issue of the equipment catalog, may be successful in providing equipment which meets the essential characteristics defined herein. Under no circumstances shall these manufacturers be excluded from the procurement process if their equipment is demonstrated to meet the applicable essential characteristics and receives the approval of the LCEM.

655-1.1.6 Equipment of different manufacturer's which is classified as functionally interchangeable is unlikely to be physically interchangeable. A situation may arise when the equipment issued by the supply system may differ from that requisitioned. If there are unusual circumstances, such that existing space configuration constraints would preclude installation of any equipment other than that presently in place without extensive modifications to the ship's configuration and/or extensive service modifications or the equipment within the same category [that is, laundry presses, washer-extractor 35 to 200 pounds, etc.] would not be from the same manufacturer, causing an operational, maintenance, repair or logistics problem for the ship, the advice code of the requisition should indicate "2B" for no substitute acceptable. A justification statement for sole source procurement must also be entered in the remarks block. Minor changes to foundations and/or services are not considered acceptable sole source justification and will be rejected.

655-1.1.7 Unless the urgency of the situation dictates otherwise, local procurement of laundry and dry cleaning equipment and spare parts is discouraged. When the central supply system is circumvented, vital demand information is not recorded at Navy Ships Parts Control Center (NSPCC) or Defense General Supply Center (DGSC). Without that information, NSPCC and DGSC cannot effectively forecast budget requirements for future equipment procurements and spare parts stock. Local procurement must be authorized by NSPCC or DGSC and shall only be used in instances when the lead time of the central procurement process prohibits timely delivery of the equipment to support the installation schedule. Regardless, whatever is requested, it must be equivalent to the equipment in the catalog and meet the essential characteristics defined in this technical manual. Any interim changes or additions to the equipment's essential characteristics in place at the time of this publication are retained at NSWCCD-SSES. Most of the equipments shown in the **Shipboard Laundry and Dry Cleaning Equipment Catalog** have National Stock Numbers (NSN's) and Allowance Parts Lists (APL's) assigned and are managed by NSPCC or DGSC.

655-1.2 LAUNDRY AND DRY CLEANING PROCESS

655-1.2.1 Surface ships with 100 or fewer accommodations and submarines are designed with a self-service laundry facility generally outfitted with one 16-20 pound washer-extractor and one 16-20 pound tumbler-dryer. Each individual is responsible for doing his/her own laundry. Shirts and dungarees are usually done separately from the whites which results in at least two loads per individual per week. Finishing is done by each individual on ironing boards located within the laundry or living spaces.

655-1.2.2 Surface ships with 100 or more accommodations are designed with manned, bulk laundries. Bulk laundries on large ships have four basic areas; receiving, wash/dry, finishing, and issuing areas. Receiving and issuing areas are generally adjacent to the compartment access on opposite sides of the laundry on larger ships and adjacent to each other by the laundry access on smaller ships.

655-1.2.2.1 Due to the differences in laundry handling practices and uniform materials, the laundering process for crew and troops (E-6 and below) is slightly different from that of Chief Petty Officer (CPO's) and Officer. Crew and troop dirty clothing is stowed in soiled clothes lockers within the berthing compartments. This clothing is bagged in separate bulk laundry bags for whites and blues and is transported to the laundry by the compartment cleaner. Officer's and CPO's dirty clothing is assembled in individual lots and transported to the laundry by Food Service Attendants (FSA). Upon receiving the laundry, the E-6 and below bagged laundry is individually weighed and transferred to the washer-extractor. Bagged laundry is not sorted or combined directly with other bulk laundry due to the high volume of E-6 and below laundry, manpower limitations and accountability requirements. CPO clothing however, is combined with the Officer's lots which are individually marked, sorted, combined into like materials and transferred to the washer-extractor. Due to the different handling processes, open pocket machines, up to 50 pounds capacity, are better suited for washing the combined lots of Officer and CPO clothing, whereas multi-pocket machines, between 100 and 200 pounds capacity, are better suited for washing E-6 and below clothing. Larger capacity multi-pocket machines provide an efficient means to process the high volume of E-6 and below laundry while easily maintaining the accountability of the bulk divisional loads. The smaller capacity open-pocket machines provide a more convenient means to process the much lower volume of E-7 and above laundry, and other sorted material such as bed and table linens. After completion of the wash cycle, cleaned clothes are removed and transferred directly to the tumbler-dryers or finish work transferred to the pressing station. Dried clothing is placed back into laundry bags, finished clothes are placed on hangers and sent to the issuing area.

655-1.2.3 A self-service laundry shall not be installed unless approved by NAVSEA. Self-service laundries, if authorized, shall be designed using authorized shipboard equipment contained within the **Shipboard Laundry and Dry Cleaning Equipment Catalog** or as authorized by the Life Cycle Equipment Manager and installed in accordance with **General Specifications for Ships of the U.S. Navy** .

655-1.2.4 Complete dry cleaning and tailoring facilities shall be provided on ships with 1500 or more accommodations for dry cleaning, finishing, spotting (spot removal) and minor repair of uniforms. Dry cleaning machines shall be installed separate from the laundry, however when practical, it should be adjacent to the manned laundry facility so that a common receiving and issuing access area is provided. Dry cleaning finishing equipment shall be in the same compartment as the dry cleaning machine. However, supplemental dry cleaning finishing equipment may be installed in the same compartment as the laundry finishing equipment so that the dry cleaning press may backup the laundry presses to finish press Certified Navy Twill (CNT) garments. CNT may be easily damaged on a hot head laundry press if improperly pressed. On small ships without a dry cleaning facility, one general utility dry cleaning press and vacuum unit, or one modified hot head press on ships with all electric laundries, shall be installed in the laundry compartment to press CNT's and wool. The modified electric hot head press shall have a grid plate installed on the head and the head and buck thermostats shall be reduced to prevent melting of the fabric.

655-1.3 EQUIPMENT SELECTION

655-1.3.1 The selection and mix of laundry and dry cleaning equipment depends not only on the total accommodation level of the ship but also the specific officer, CPO and E-6 and below manning levels. Whenever possible, equipment shall be selected from a single manufacturer for each equipment category in order to reduce a

ship's logistical support requirements and minimize operational and maintenance training requirements. Examples of equipment categories are: 50 and 100 pound capacity tumbler-dryers, laundry/dry cleaning presses, 35 to 200 pound capacity washer-extractors etc.

655-1.3.2 The Navy's philosophy when determining the recommended distribution of washer-extractor and tumbler-dryer capacities is to typically take into account equipment down time so as not to render the laundry facility largely, or fully inoperative. For example, two 100 pound capacity washer-extractors in place of one 200 pound capacity washer-extractor is considered the better choice in order to provide back up capacity should a machine become inoperable. However, the philosophy of building in equipment redundancy instead of maximizing the capacity per square foot ratio comes at the expense of reduced operational efficiency, increased procurement and installation costs, excess manning, additional space requirements, increased weight, and greater maintenance and spare parts support. Future installations must take into account the entire life cycle costs of installing redundant equipment in order to find a more cost effective balance between equipment redundancy and maximization of the capacity to square foot ratio. Higher capacity multi-pocket machines, with per pocket capacities better suited to Navy's operating methods, are currently available and should be considered as substitutes for lower capacity machines in order to maximize capacity to square foot ratio and minimize the inherent disadvantages of redundant equipment installations.

655-1.3.3 The actual washing process previously described in paragraph [655-1.2.2.1](#) must also be taken into account when selecting the mix of washer-extractors. As previously described, E-6 and below divisional laundry is transported in bulk laundry bags, typically weighing approximately 50-60 pounds, and washed either together in a open or common pocket or equally split and distributed among smaller capacity pockets. Therefore, the selection of a multi-pocket machine(s) in the 50-70 pound per pocket capacity range is ideally suited to efficiently process the E-6 and below laundry. Machines with smaller pocket capacities normally require additional operator steps, unnecessary sorting of the common load and will slow the laundry process. Machines with pocket capacities larger than 70 pounds, such as a 2-pocket, 200 pound machine, creates wasted capacity since the maximum per pocket load is rarely over 65-70 pounds. As an example, a single 150 pound capacity 3-pocket machine is considered a better choice than two 60 pound capacity 3-pocket machines. High capacity multi-pocket machines are also suited for processing E-7 and above laundry on larger ships such as aircraft carriers and amphibious ships due to the high manning levels and volume of laundry. However, since the E-7 and above laundry is sorted and combined into like loads the selection of an open pocket machine(s) dedicated to E-7 and above laundry may be better suited to efficiently process the laundry. The open pocket machine will eliminate the unnecessary steps of splitting the combined laundry into smaller lots to suit the smaller pockets of a multi-pocket machine. For example, two open pocket 50 pound capacity machines is a better choice than a 100 pound multi-pocket machine. On smaller ship's such as cruisers and destroyers E-7 and above laundry, in addition to bed and mess linens, can be efficiently processed in a single 50 pound open pocket machine.

655-1.3.4 Available manpower requirements for operations, maintenance, and repair are also considered in the laundry and dry cleaning equipment selection process. Specialized high-production, automated equipment, such as tunnel washers and cabinet presses, is not specified over lower-production equipment, which perform the basic laundering functions, since the selection of specialized high-production equipment increases training requirements for the operators and maintenance personnel and also increases shipboard logistic support.

655-1.4 LAUNDRY HABITABILITY DESIGN REQUIREMENTS

655-1.4.1 The basic habitability requirements for shipboard laundry facilities are set forth in **General Specifications for Ships, Section 655** and **OPNAVINST 9640.1** and reiterated herein.

655-1.4.1.1 Submarine laundries shall be provided with a minimum of one 16 pound capacity washer-extractor, one 16 pound capacity tumbler-dryer, three hand irons, and three ironing boards.

655-1.4.1.2 Surface ships that deploy with a 100 or fewer accommodations, shall be provided with self-service laundry facilities which should include, as a minimum, one 16 pound capacity washer-extractor, one 16 pound capacity tumbler-dryer, three hand irons and three ironing boards.

655-1.4.1.3 Surface ships that deploy with more than 100 accommodations (crew plus troops) shall be provided with manned, bulk laundry facilities capable of meeting the following minimum requirements for a 96-hour laundry operation per week:

1. One change of work clothing, underwear, socks, and one towel per day per accommodation.
2. One change of berth linen per accommodation and one change of officer and CPO dining facility linen, per week.
3. Finish press three work uniforms (shirts and trousers) per officer and E-7 through E-9 accommodation per week.
4. Finish press one dress uniform shirt and trouser per crew (plus troops) accommodation per week.

655-1.4.1.3.1 The laundry weight capacity per accommodation has been calculated to be approximately 24 lb per week.

655-1.4.1.4 Tender and repair ships shall have laundry facilities capable of performing their own laundry needs as defined in paragraph [655-1.4.1.3](#) plus those of the vessels being tended. This increased laundry capacity for a tender or repair ship should be able to support as a minimum the accommodations of two ships or submarines normally tended.

655-1.5 LAUNDRY EQUIPMENT SELECTION

655-1.5.1 The production rate of a washer-extractor is one load (normal capacity) per hour. This production rate takes into account downtime, light loads, and loading and unloading times.

655-1.5.2 The production rate of a tumbler-dryer is one load (nominal capacity) per 45 minutes or 1.33 loads per hour. This production rate takes into account downtime, light loads, and loading and unloading times. Roughly 70-75 percent of the wash load goes to the tumbler-dryers. The remaining, consisting of flatwork and officer and CPO uniforms goes directly to the presses. The required drying capacity is therefore determined by the ship's wash capacity per hour. As a general rule, dryer capacity can be determined by calculating no less than 50 percent of the required washer-extractor capacity. However, for optimum matching of wash and dry capacities and to ensure a continuous work flow a design goal of 75 percent is recommended.

655-1.5.3 When calculating washer-extractor and dryer capacities the final selection of equipment shall be rounded to the next highest single capacity of equipment available (i.e. 35 or 50 pound open-pocket and 100, 150 or 200 pound multi-pocket washer-extractors and 50 and 100 pound tumbler-dryers). 16-20 pound capacity washers and dryers, installed for C.O., VIP and officers of equivalent rank, should not be used in calculating total wash and dry capacities.

655-1.5.4 The production rate for laundry finishing equipment is based upon the arrangement of laundry presses to form operator work stations and upon the item (i.e. trousers, shirts or flatwork) being pressed. The standard laundry press work station consists of two utility presses and one pants topper press arranged in a U-shaped configuration to allow the operator to finish press multiple garments at one time.

655-1.5.5 The minimum quantity and capacity of laundry equipment needed to meet the habitability laundry requirements of OPNAVINST 9640.1 based on the ship's accommodation level is provided in [Table 655-1-1](#). [Table 655-1-1](#) is based on a properly manned laundry operating 96 hours per week.

Table 655-1-1 MINIMUM LAUNDRY EQUIPMENT QUANTITIES PER ACCOMMODATION LEVEL (96-HOUR WORK WEEK)

ACCOMMODATIONS			WASHER-EXTRACTORS					TUMBLER-DRYERS			LAUNDRY PRESSES		
TOTAL	E-7 & ABOVE	E-6 & BELOW	OPEN-POCKET		3-POCKET			20#	50#	100#	UTILITY	PANTS TOPPER	F.W. IRONER
			18#	35#	50#	100#	150#						
0 - 400	0 - 140	0 - 400	1	1		1		1	2		2	1	
0 - 540	0 - 140	0 - 400	1	1		1		1	2		4	2	
401 - 740	0 - 140	401 - 600	1	1			1	1	3		4	2	
601 - 940	0 - 140	601 - 800	1	1		2		1	4		4	2	1
942 - 1400	141 - 200	801 - 1200	1		1		2	1	5		6	3	1
1082 - 1600	281 - 400	801 - 1200	1		2		2	1	5		6	3	1
1402 - 1880	201 - 280	1201 - 1600	1	2				1	1	3	6	3	1
1882 - 2400	281 - 400	1601 - 2000	1		2	1		1	2	3	8	4	1
2282 - 2800	281 - 400	2001 - 2400	1		2			1	1	4	8	4	1
2682 - 3200	281 - 400	2401 - 2800	1		2			1	2	4	8	4	1
4802 - 5800	801 - 1000	4001 - 4800	1		5			1	2	8	8	4	1
5602 - 6600	801 - 1000	4801 - 5600	1		5			1	2	10	8	4	1

655-1.6 DRY CLEANING HABITABILITY DESIGN REQUIREMENTS

655-1.6.1 The basic habitability requirements for shipboard dry cleaning facilities are set forth in OPNAVINST 9640.1 and reiterated herein.

655-1.6.2 Surface ships with an accommodation level between 100 and 1500 shall have the ability to finish press one dress uniform per accommodation per month. The dry cleaning press shall be installed in the ship's laundry.

655-1.6.3 Surface ships with an accommodation level above 1500 shall have dry cleaning equipment and finishing capability to clean one dress uniform bi-monthly and finish press one dress uniform per month per accommodation. The dry cleaning load capacity per accommodation has been calculated to be 2.0 pounds per month.

655-1.6.4 Tender and repair ships shall have increased dry cleaning facilities capable of accommodating the dry cleaning needs of tended ships in addition to the requirements of their own ship's company. The dry cleaning capacity of a tender should be increased to support as a minimum the accommodations of two ships or submarines normally tended.

655-1.7 DRY CLEANING EQUIPMENT SELECTION

655-1.7.1 There are two major work stations within a shipboard dry cleaning facility for ships with more than 1500 accommodations. The two different work stations are; (1) the dry cleaning machine(s) and spotting board and (2) the finishing area consisting of a combination of two or three utility presses, one pants topper press and one form finisher.

655-1.7.2 The production rate of a dry cleaning machine is two loads (normal capacity) per hour. This production rate takes into account downtime, light loads, and loading and unloading times.

655-1.7.3 The minimum quantity and capacity of dry cleaning equipment needed to meet the habitability dry cleaning requirements of OPNAVINST 9640.1 based on the ship's accommodation level is provided in [Table 655-1-2](#). [Table 655-1-2](#) is based on a properly manned dry cleaning facility operating 96 hours per week.

**Table 655-1-2 MINIMUM DRY CLEANING EQUIPMENT QUANTITIES
PER ACCOMMODATION LEVEL (96-HOUR WORK WEEK)**

ACCOMMODATIONS	DRY CLEANING MACHINE	SOLVENT STORAGE TANK	DRY CLEANING PRESSES					SEWING MACHINES	
			UTILITY	PANTS TOPPER	FORM FINISHER	SPOTTING BOARD	MEDIUM DUTY LOCK STITCH	MEDIUM DUTY BLIND STITCH	
0 TO 100									
101 TO 166			1						
167 TO 361			1						
362 TO 646			1						
647 TO 760			1						
761 TO 1002			1						
1003 TO 1401			1						
1402 TO 1596	1	1	2	1	1	1	1	1	1
1597 TO 1757	1	1	2	1	1	1	1	1	1
1758 TO 1952	1	1	2	1	1	1	1	1	1
1953 TO 2261	1	1	2	1	1	1	1	1	1
2262 TO 2707	1	1	2	1	1	1	1	1	1
2708 TO 3211	1	1	2	1	1	1	1	1	1
3212 TO 3496	1	1	2	1	1	1	1	1	1
3497 TO 3852	1	1	2	1	1	1	1	1	1
3853 TO 4135	1	1	2	1	1	1	1	1	1
4136 TO 4465	1	1	2	1	1	1	1	1	1
4466 TO 4803	1	1	2	1	1	1	1	1	1
4804 TO 5088	1	1	2	1	1	1	1	1	1
5089 TO 5444	2	1	2	1	1	1	1	1	1
5445 TO 6200	2	1	2	1	1	1	1	1	1

655-1.8 LAUNDRY AND DRY CLEANING EQUIPMENT SPACE ARRANGEMENT

655-1.8.1 The arrangement principles for laundry and dry cleaning equipment and facilities are as follows:

655-1.8.1.1 Work flow process shall start with receiving and end at issuing in as direct a path as possible; that is, no long transits or circuitous routes between equipment and processes.

655-1.8.1.2 Washer-extractors and deep sinks shall be grouped together and surrounded by a coaming to contain spills which will direct the spillage to a deck drain(s).

655-1.8.1.3 Load transfer route between washer-extractors and tumbler-dryers shall be minimized by installing washer-extractors and tumbler-dryers across a common aisleway whenever practical.

655-1.8.1.4 Equipment having revolving drums on a horizontal axis shall be oriented such that the axis of rotation is fore and aft.

655-1.8.1.5 A dutch door shall be installed adjacent to the receiving and/or issuing area so that the laundry bags can be deposited or retrieved from the laundry near the soiled or cleaned laundry bag stowage areas respectively. The location of the dutch door shall allow the individual depositing or retrieving the laundry bags to observe their weighing. If space permits a passing window shall also be installed adjacent to the receiving and/or issuing areas.

655-1.8.1.6 The issue and/or receiving areas shall have counter space 24 inches wide by 36 inch high and a length sufficient for receiving, issuing, sorting, marking, and maintaining laundry records. The issuing and/or receiving counter shall be provided with CRES sorting bins over and underneath the counter if space permits. The issuing and/or receiving window shall provide the operator with easy access to the issue bins, cleaned and soiled laundry bag stowage, and scale(s). A shelf shall be adjoined to the issuing and/or receiving doors where space does not permit the installation of counters.

655-1.8.1.7 Adequate access for wheeled laundry baskets shall be provided in aiseways in and around the finishing stations, washer-extractors, tumbler-dryers, and dry cleaning machines.

655-1.8.1.8 Provisions shall be made at finishing work stations and issuing areas to hold finished work. Jackrods, constructed of CRES rod, shall be provided in the overhead to hold the finished garments on hangers. The jackrod shall be located directly outside the finishing work station and the jackrod supports shall not obstruct the movement of the hangers along the jackrods. The amount of jackrod length in the issuing area is based on 6 inches of jackrod for each officer, and CPO through MCPO accommodation. Approximately 80 percent of the jackrod length may be arranged two rails high. The two rail high jackrod for shirts and jackets shall be spaced 42 and 82 inches above the deck.

655-1.8.1.9 A 24 inch wide by 36 inch high table, equivalent to two-thirds of the length of the rolls on the flatwork ironer, 60 inch for class B or 85 inch for class A, shall be located 30 inch from the front of the flatwork ironer. The table leg arrangement shall allow for laundry basket stowage under the table.

655-1.8.1.10 Space should also be allocated within the washer-extractor coaming area for water heaters, accumulators, and pumps for supplying the washer-extractors with 120° to 140°F hot water. If the water heater and washer-extractors are not grouped together a separate area coaming with deck drains shall be provided.

655-1.8.1.11 Dry cleaning machines, spotting board(s), and dry cleaning solvent storage tanks shall be isolated in a separate compartment from the laundry space and should be connected by doors and passageways to the laundry.

655-1.8.1.12 Exhaust ventilation of the dry cleaning space shall be independent of any other compartment and discharge overboard so as not to contaminate any intake ducts. The ventilation system should be interlocked with the dry cleaning machine to prevent dry cleaning machine operation without exhaust and supply ventilation.

655-1.8.1.13 Dry cleaning machines shall be installed within a coaming. The coaming shall be sized to contain spills equivalent to 110 percent of the total storage capacity of the dry cleaning machine(s). A deck drain is not permitted within this coaming area.

655-1.8.1.14 Adequate clearance shall be provided around the equipment to allow for proper operations, maintenance, and repair.

655-1.8.1.15 The laundry shall be located near the high concentrations of crew living spaces, where practicable, since 85 percent of the laundry is generated by the crew. Ensure the location minimizes structural access cuts for large capacity washer-extractors (200lb), tumbler-dryers (100lb) and dry cleaning machines (20lb) which require dedicated shipping routes. Avoid locations with excessive ship motion and vibration in order to prolong the life of the equipment. Service piping and ventilation considerations generally will keep laundries at the third deck or above.

655-1.8.1.16 Eye/face wash station (minimum 15 minute flush time) fitted to the service sink/stationary tub shall be provided in the laundry and dry cleaning space for preliminary first aide treatment for chemical injuries.

655-1.8.1.17 A drinking fountain shall be provided in a central location in the laundry.

655-1.8.1.18 Sorting bins shall be provided in the receiving and issuing areas for holding assembled lots of officer and CPO clothing. Sorting bins shall be 10 inches wide, 12 inches deep and 8 inches high with a 1 inch retaining lip on the bottom front of each bin. The minimum number of sorting bins shall be 25 percent of the officer through CPO accommodations or 50 percent where space permits.

655-1.8.1.19 A corrosion resisting spray gun shall be suspended over each laundry press work station. The spray gun shall have ten feet of rubber or neoprene hose, complete with fittings, and a safety shut-off valve at the water connection end. The spray gun shall be a pistol type, leakproof, and the shut-off shall be located outside the water passage. The spray gun shall be designed to spray a fine water mist with a minimum water pressure of 5 pounds per square inch (psi). A small bin shall be installed in a convenient location for stowage of the spray gun.

655-1.8.1.20 A stowage rack shall be installed adjacent to each washer-extractor chemical supply bin for retaining two standard 40 pound Navy 2-Shot detergent containers.

655-1.8.1.21 One chair in accordance with federal specification AA-C-275, type I, class I, style B shall be provided for each sewing machine.

655-1.8.1.22 A stool in accordance with NAVSHIPS No. 805-1627547 drawing, type V, shall be provided for each receiving counter, issuing counter, or receiving and issuing counter.

655-1.8.1.23 Soiled and clean laundry bag stowage shall be provided. Soiled laundry bag stowage shall be located in the receiving area. Clean laundry bag stowage shall be located in the issuing area. The deck area needed for clean and soiled laundry bag stowage shall be equal in square feet to approximately 5 percent of the total accommodations up to 2,601 and 4 percent of the total accommodations above 2,602. Clean and soiled laundry bag stowage shall be fitted with deck grating in order to keep the laundry bags off the deck. The aluminum deck grating shall be in accordance with MIL-G-18014, Type B or MIL-G-18015, Type IV. Cleaned and soiled laundry bag stowage which is not bound by bulkheads shall be circumscribed by telescopic battens. The telescopic battens shall be similar to NAVSHIP No. 805-1749068 drawing and shall be installed as shown on the drawing.

655-1.8.1.24 A storage room directly accessible from the laundry shall be provided on ships with an accommodation level of 300 and above. The storage room shall be outfitted with lockers and shelving to store laundry chemicals, tools, and spare parts. On ships with fewer than 300 accommodations lockers or shelves shall be provided within the laundry space.

655-1.8.1.25 A hanging type, dial indicating or linear spring scale shall be provided in the receiving and issuing areas. The range of the scale shall be 0 to 100 lb. The scale shall be positioned in the receiving and issuing area so that the weighing of the laundry bags can be observed by the receiving attendant and the compartment cleaner or steward delivering the laundry bags. Hooks for these scales shall be provided near the washer-extractor so that the washer-extractor can be properly loaded.

655-1.8.1.26 A single compartment stationary tub shall be installed within the laundry and dry cleaning spaces. Two 1/2 inch faucets shall be installed on each stationary tub, one for cold and one for hot potable water.

655-1.8.1.27 A mastic deck covering shall be used within the coaming areas of the laundry and dry cleaning spaces. The remaining deckplate within the laundry space, dry cleaning space, and issue and receiving areas shall be covered with quarry tile.

655-1.8.1.28 Fluorescent lighting illumination within the laundry and dry cleaning space shall be an average of 14 foot-candles, except around laundry and dry cleaning finishing work stations where the lighting illumination shall be an average of 28 foot-candles.

655-1.8.2 Laundry/dry cleaning equipment shall be operated by qualified personnel in accordance with instructions contained in the Ship's Serviceman Laundry Handbook, NAVEDTRA 10293, and Navy approved equipment technical manuals.

655-1.8.3 In addition to electric power, ship's laundry/dry cleaning equipment should be provided with the following utilities as specified by the equipment technical manual:

1. Cold, fresh potable water
2. Hot 120° to 140°F fresh potable water.
3. Seawater
4. Drainage
5. Steam, 35 to 100 psi
6. Low Pressure Air, 100 psi

7. Chilled water

8. Ventilation

655-1.9 WASHER-EXTRACTORS

655-1.9.1 Washer-extractors perform the following principle functions: water and chemical injection, wash/clean, rinse, drain, and water extraction. Washer-extractors are comprised of two basic parts: an outer shell or tub and a revolving cylinder within that tub. The shell holds the water and chemicals and the revolving cylinder holds the clothing. The cylinder is highly perforated with small holes on its outer surface. These small holes allow the chemicals and water to enter, saturate and pass through the clothing while retaining the clothing within the cylinder. The clothing is cleaned by mechanical and chemical action. The mechanical action is dependent on the number and height of the rises and falls of the clothing per unit of time within the cylinder. Chemical action is dependent on the correct amount of chemical product per unit volume of water. Too much chemical product per unit volume of water causes chemical particle entrapment within the garment fibers which causes yellowing of the garment during drying or finishing. Too little chemical product per unit volume of water decreases chemical cleaning action. Extraction is performed after the tub has been drained to remove large amounts of water from the clothing. The extraction process is created by the acceleration of the cylinder from the slow rotation of washing to a much faster rotation. With the cylinder rotating at a high rate of speed, the centrifugal force removes the majority of the water from the clothing.

655-1.9.2 Washer-extractors having a load capacity of 35 to 200 pound shall be manufactured in accordance with the following configurations:

Type I -	Steam booster heater
Type II -	Electric booster heater
Class 2 -	Microprocessor automatic formula control unit
Class 3 -	Programmable logic control automatic formula control unit
Style A -	Unsectionalized
Style B -	Sectionalized
Grade a -	Open-pocket
Grade b -	Multi-pocket

655-1.9.3 The applicable essential characteristics for washer-extractors having a load capacity of 35 to 200 pounds, are described in the following paragraphs.

655-1.9.3.1 The machine shall be front loading, either open pocket for capacities 50 pounds or less or multi-pocket for capacities 100 pounds or greater. The machine shall be complete with a formula control unit to automatically control the machine through a complete programmed wash formula including fill, wash, heat, drain, rinse, extract, clutching, braking and supply injection.

655-1.9.3.1.1 Class 2 control unit shall be programmable and capable of storing a minimum of four independent wash formulas having a minimum of 25 separate steps.

655-1.9.3.1.2 Class 3 control unit shall be preprogrammed with three standard Navy wash formulas and a single short cycle test formula. Program shall be stored in EEPROM memory. The control unit shall be capable of changing it's operational content by installing a replaceable EEPROM cassette which will override the original programming. An integrated male pin connector for manual over-ride operation shall be located in an accessible area on the back of the control panel electrical box enclosure. The phases of the manual operation shall include individual control of hot and cold water valves, wash motor, extract motor, drain valve and heater. Operation shall be controlled by a remote hand held controller with a female pin connector and individual switches corresponding to each phase of the manual operation. The pin connectors shall be threaded and the male fitting provided with a protective cap. The cable installed on the hand held controller shall be of sufficient length to allow operation from the front of the machine.

655-1.9.3.1.3 A dual set point temperature gauge and display shall be provided on the control unit. The gauge shall allow the operator to select either a tempered or heated bath temperature. The tempered setting shall thermostatically control admittance of hot water to the machine and temper with cold water as necessary. The heated setting shall admit hot water or a mix of hot and cold water as directed by the formula control unit and thermostatically control the activation of the booster heater as necessary to reach the set point temperature. The booster heater shall not activate until the minimum water level is reached and timing of the formula shall not proceed until the set point temperature is reached. The gauge shall allow the operator to select and adjust not less than two set-point temperatures from 60 to 220°F.

655-1.9.3.1.4 The control unit shall automatically control the water level for not less than two separate independent water levels and a safety water level which shall be readily readjustable in the field. Timing of the formula shall not proceed until the proper water level is reached. The safety water level shall be interlocked with the machine in such a way as to prevent extraction should the water level in the shell be above a preset safe level.

655-1.9.3.2 The machine shall have a multi-compartment automatic supply dispenser. The supply dispenser shall automatically add supplies at the correct time as directed by the formula control unit. A single opening in the shell shall also be provided for the manual addition of supplies.

655-1.9.3.3 The machine shall be equipped with an indirect steam injection or electric immersion booster heater unit. Booster heater shall increase water temperature by 15 degrees F per minute for type I machines and 10 degrees F per minute for type II machines. The booster heater shall be located in the tub to remain submerged at inclined angles of 12 degrees at a minimum water level of four inches for Type I machines and eight inches for Type II machines. The booster heater shall not be activated until the proper water level has been reached. Direct live steam injection into a washer-extractor is prohibited due to possible boiler water contamination.

655-1.9.3.4 The machine shall function without reduction in performance when operating at angles of 12 degrees to each side of a vertical plane.

655-1.9.3.5 An electric interlock shall prevent the shell door from opening during the extract mode and stop the machine in wash mode should the shell door be opened.

655-1.9.3.6 The machine shall be equipped with an adjustable vibration limit cut-out device to disconnect service should excessive, equipment damaging vibration occur.

655-1.9.3.7 The machine shall be provided with mounting bolt connections in order to secure the base of the machine to a hull foundation. The connections shall ensure adherence of the machine to the foundation under machinery and ship induced vibrational forces and ship motion.

655-1.9.3.8 The machine shall extract water to the extent that the water retention of the material shall not be greater than 55 percent after 5 minutes of extraction.

655-1.9.3.9 Style B machines shall be constructed to be disassembled, transported, and reassembled within the ship without welding or brazing. Major subassemblies shall bolt together. Limiting dimensions for each major subassembly shall be 50 inches high, by 25 inches wide, by 36 inches deep. Subassemblies shall be matched-marked to assist in field reassembly. Touch-up paint and spare hardware shall be provided.

655-1.9.3.10 Exposed belts, shafts, pulleys and other moving parts shall be fully enclosed by metal guards. Guards shall be firmly supported but readily removable for maintenance.

655-1.9.3.11 An emergency stop button shall be located on the front of the machine within an accessible area. The button shall bring the machine to an immediate stop when activated.

655-1.9.3.12 The machine shall provide reversing rotation of the cylinder when in the wash mode. The cylinder shall reverse a minimum of three times per 95 seconds.

655-1.9.3.13 Flexible steam supply and condensate lines shall be composed of extruded or convoluted tetrafluoroethylene hose with stainless steel (CRES) braided reinforcement and threaded end couplings. Steam supply and condensate flexible hose assemblies shall be in accordance with the Society of Automotive Engineers (SAE) AS604 or AS620 specifications and NSTM S6430-AE-TED-010. Pipes, fittings, valves, hoses, etc. using steam shall be suitable for 100 psi working pressure.

655-1.9.3.14 The machine shall operate on 440-volt, 60-hertz, 3-phase electrical system. The equipment shall conform to the recommended practices for electrical installation on board ship in accordance with IEEE 45 and shall be on an ungrounded electrical system. No grounds shall be permitted on the machine wiring. All wiring shall be contained within protective sleeves. All electrical panels, sleeves and fittings shall be drip proof. Electrical motor enclosures shall be dripproof or better.

655-1.9.3.15 JOG buttons shall be provided on multi-pocket machines for inching the cylinder door to the proper loading position. JOG buttons shall require the operator to use both hands. The cylinder shall stop upon release of either JOG or directional buttons.

655-1.9.4 Washer-extractors having a load capacity of 16 to 20 pounds shall be manufactured in accordance with the following configurations:

Type I -	For submarines
Type II -	For surface ships

655-1.9.5 The applicable essential characteristics for washer-extractors having a load capacity of 16 to 20 pound, are described in the following paragraphs.

655-1.9.5.1 The machine shall be front loading and fully automatic. The timer-programmer shall be preprogrammed by the manufacturer to automatically control the fill, wash, drain, rinse, extract and detergent dispensing operations of the machine through the entire cycle.

655-1.9.5.2 Temperature selector switches shall be provided to allow the operator to select three wash and two rinse water temperatures as follows: hot wash-warm rinse, warm wash-warm rinse, warm wash-cold rinse and cold wash-cold rinse.

655-1.9.5.3 An automatic water level control shall be provided to control not less than two water levels. Selection of the water level shall be provided on the control panel.

655-1.9.5.4 Type I washer-extractors shall be constructed to be disassembled into sections or parts that can be passed through a 25-inch diameter submarine hatch and reassembled in the laundry space. Type II washer-extractors shall be constructed to be disassembled into sections or parts that can pass through a 26 by 66 inch radius cornered watertight door and be reassembled in the laundry space. Separation and reassembly of parts by welding, riveting, cutting or similar means shall not be used to meet the disassembly requirement.

655-1.9.5.5 Type I washer-extractor overall dimensions shall not be greater than 34 inches high, 24 inches wide and 32 inches deep. Type II washer-extractors shall not be greater than 51 inches high, 28 inches wide and 32 inches deep.

655-1.9.5.6 Water consumption shall not be greater than 50 gallons for the maximum rated load capacity.

655-1.9.5.7 The base of the machine shall be fitted with not less than four bolt holes for anchoring the machine to a hull foundation.

655-1.9.5.8 Type I and II machines shall be provided with a chemical supply door for manual dispensing of detergent. In addition, Type II machines shall be provided with a automatic supply dispenser for adding chemicals as controlled by the timer-programmer. The chemical supply door shall be rigidly attached to the top of the cabinet. The dispensing compartment shall be configured in such a way as to prevent water or detergent from splashing on any adjacent control wiring in the upper cabinet housing.

655-1.9.5.9 Exposed belts, shafts, pulleys and other moving parts shall be fully enclosed by metal guards. Guards shall be firmly supported but readily removable for maintenance.

655-1.9.5.10 An electric interlock shall be provided to prevent opening the door until the cylinder is at rest and prevent rotation of the cylinder when the shell door is opened.

655-1.9.5.11 The machine shall function without reduction in performance when operating at angles of 12 degrees to each side of a vertical plane.

655-1.9.5.12 The washer-extractor shall extract water from saturated material to a water retention rate of not greater than 80 percent of the normal dry weight.

655-1.9.5.13 Type I washer-extractors shall meet the grade B shock requirements in accordance with MIL-S-901.

655-1.9.5.14 Type I washer-extractors shall meet the airborne noise levels for Grade C equipment in accordance with MIL-STD-740-1 and the structureborne noise levels for Type II equipment in accordance with MIL-STD-740-2.

655-1.9.5.15 The machine shall operate on 440-volt, 60-hertz, 3-phase or 120-volt, 60-hertz, 1-phase electrical system. The equipment shall conform to the recommended practices for electrical installation on board ship in accordance with IEEE 45 and shall be on an ungrounded electrical system. No grounds shall be permitted on the machine wiring.

655-1.9.6 Washer-extractors shall be installed in accordance with the following requirements:

655-1.9.6.1 Service piping shall contain a flexible section of hose 14 to 18 inches in length installed between the ship's service piping and the washer-extractor (see **NSTM Chapter 505, Piping Systems**).

655-1.9.6.1.1 Steam supply and condensate lines shall be composed of extruded or convoluted tetrafluoroethylene hose with stainless steel (CRES) braided reinforcement and threaded end couplings. Steam supply and condensate flexible hose assemblies shall be in accordance with the Society of Automotive Engineers (SAE) AS604 or AS620 specifications and Naval Ship's Technical Manual S6430-AE-TED-010. The inlet steam connection shall come off of the top of the steam header.

655-1.9.6.1.2 The hot and cold water flexible hose assemblies shall be constructed of synthetic rubber hose reinforced with wire or synthetic fiber and provided with threaded end couplings in accordance with MIL-H-24135/10 or MIL-H-24136/3.

655-1.9.6.1.3 The low pressure air supply line shall be plastic tubing capable of withstanding a working air pressure of 150 psi.

655-1.9.6.1.4 The drain and overflow connections shall be made of synthetic rubber reinforced with synthetic fiber or wire sleeves.

655-1.9.6.1.5 Salt water connections shall be constructed of synthetic rubber, reinforced with wire conforming to FED Spec ZZ-H-451. The hose assembly shall have threaded CRES end couplings.

655-1.9.6.2 A dedicated ship's hot water system shall be designed for the laundry to boost the potable hot water temperature to meet the BUMED P-5010 wash water temperature requirements and to meet the washer-extractor water demands. Using the dedicated water heater to heat the wash water to the required BUMED temperature requirement will substantially increase the daily wash load output from the washer-extractors due to the time needed to boost the washer-extractor water to the required temperature. The washer-extractor supplemental booster heaters are provided as a backup to the dedicated hot water system to maintain the bath temperature and are not intended to routinely raise the wash water temperatures.

655-1.9.6.3 Salt water supply piping, flexible hose and appropriate fittings shall be provided in the laundry compartment in the event shipboard potable water is not available. The hose assembly shall be of such a length to conveniently reach each washer-extractor from the salt water supply valve in order to manually fill each machine when necessary. The salt water piping or hose assembly shall not be hard piped to the machine. The salt water hose assembly shall be located in the overhead or on a bulkhead near the washer-extractor when not in use.

655-1.9.6.4 The washer-extractor foundation shall be constructed of angle iron or similar structure properly reinforced so that it will not give under the stresses created by the machine. The foundation shall be reasonably level and flat to ensure metal to metal attachment to the washer-extractor base. The use of shims or grout to compensate for irregularities and to ensure complete bearing between mounting surfaces shall be in accordance with the manufacturer's instructions. Foundations made of long metal plates welded directly to the deck should be avoided. The use of metal plates tend to quickly disintegrate due to corrosion and vibrational forces.

655-1.9.6.5 Posting of operational and safety placards ([Figure 655-1-1](#)), chemical measuring charts, and Navy Wash Formulas I, II, and III are required adjacent to groups of 35 to 200 pound washer-extractors.

OPERATING INSTRUCTIONS AND SAFETY PRECAUTIONS

WASHER-EXTRACTOR

WARNING

THIS MACHINE SHALL BE OPERATED BY QUALIFIED PERSONNEL ONLY. SERIOUS PERSONNEL AND EQUIPMENT HAZARDS EXIST DURING THE OPERATION OF THE MACHINE. DO NOT BYPASS OR DISCONNECT ANY SAFETY FEATURE SUCH AS THE VIBRATION, EMERGENCY AND DOOR SWITCHES OR JOG BUTTONS. ALWAYS WEAR PERSONNEL PROTECTIVE EQUIPMENT WHEN HANDLING LAUNDRY CHEMICALS. THE MACHINE SHALL BE OPERATED IN AUTOMATIC MODE UNLESS SPECIAL CIRCUMSTANCES DICTATE OTHERWISE. DO NOT LEAVE THE SPACE UNATTENDED WHILE THE MACHINE IS IN OPERATION.

OPERATING INSTRUCTIONS

1. VERIFY POWER IS TURNED ON AND STEAM, WATER AND AID VALVES ARE OPENED AS APPLICABLE.
2. OPEN SHELL DOOR. ON MULTI-POCKET MACHINES JOG CYLINDER UNTIL INNER DOOR IS ALIGNED WITH THE OUTER DOOR. OPEN INNER DOOR. LOAD OPEN POCKET OR MULTI-POCKET MACHINE WITH PROPER AMOUNT OF LAUNDRY. DO NOT EXCEED THE MAXIMUM RATING OF THE MACHINE OR THE INDIVIDUAL POCKET ON MULTI-POCKET MACHINES. REPEAT THE LOADING PROCESS FOR THE REMAINING POCKETS, ENSURE THE MULTI-POCKET MACHINES ARE EVENLY LOADED TO PREVENT AN OUT OF BALANCE CONDITION.
3. CLOSE AND SECURE THE INNER POCKET AND MAIN SHELL DOOR(S). ENSURE DOORS ARE PROPERLY LATCHED AND SECURED.
4. ADD THE PROPER AMOUNT OF "TWO-SHOT" DETERGENT TO THE MANUAL SUPPLY BIN OR AUTOMATIC SUPPLY BIN #1 AND SOUR BLUE TO AUTOMATIC SUPPLY BIN #2.
5. VERIFY PROPER TEMPERATURE SETTINGS FOR THE SELECTED FORMULA AND ADJUST ACCORDINGLY.
6. START THE MACHINE. FOR ELECTRO-MECHANICAL CONTROLLED MACHINES ALIGN THE DRUM TO THE START OF FORMULA AND SET SWITCHES FOR AUTOMATIC OPERATION. TURN TIMER ON. FOR MICROPROCESSOR OR PROGRAMMABLE LOGIC CONTROLLED MACHINE SELECT DESIRED FORMULA AND BEGIN AUTOMATIC OPERATION BY DEPRESSING THE FORMULA AND/OR RUN BUTTON AS APPROPRIATE.
7. ALLOW THE MACHINE TO OPERATE THROUGH THE FULL AUTOMATIC OPERATION. PERIODICALLY MONITOR THE MACHINE OPERATION AND INFORM THE LAUNDRY SUPERVISOR OF ANY ABNORMAL OPERATION.
8. UNLOAD MACHINE FOLLOWING CYCLE COMPLETION AND TRANSFER CLOTHES TO DRYER OR PRESS STATION.

Figure 655-1-1 Operational and Safety Placard, Washer-Extractor

655-1.9.6.6 The washer-extractor deck area shall be surrounded by a 3 inch coaming with a 1/2 inch diameter corrosion resisting rod permanently attached on top of the coaming to retain water spills from the washer-extractors. The coaming area shall contain a deck drain(s) to drain off water spillage. The coaming area is not to be used to drain the washer-extractors into the ship's drainage system. The washer-extractor(s) discharge drain line shall be directly connected to the ship's drainage system.

655-1.9.6.7 Washer-extractors installed with steam condensate lines shall use an orifice assembly. The strainer in the orifice assembly shall be installed upstream or in front of the orifice plate. The steam condensate lines should have a y-strainer installed upstream from the orifice and a stop check valve installed downstream from the orifice.

655-1.9.6.8 The deckplate shall be reinforced to prevent vibration amplitudes from exceeding those amplitude levels specified in the latest revision of the General Ship Specifications, chapters 655 and 095-655.

655-1.9.6.9 When practical, and in particular on smaller vessels, washer-extractors should be installed onboard ship so that the axis of the cylinder is fore-and-aft. Sufficient space shall be provided around the washer-extractor to allow for operation, maintenance, and repair.

655-1.9.6.10 Installations of washer-extractors require the use of an accessible/removable drainline strainer to prevent articles of clothing and other random objects from passing through the drainage system and potentially clogging or damaging CHT pumps.

655-1.9.7 In order to ensure safe and proper washer-extractor operation the following installation and operational check-out procedures are recommended:

655-1.9.7.1 Ensure that drive belts are adjusted to the correct tension. The ideal belt tension is the lowest tension at which the belt will not slip under peak load conditions. Over tensioning of belts shortens belt and bearing life.

655-1.9.7.2 Ensure that safety guards are securely in place.

655-1.9.7.3 Ensure that the automatic formula controller operates properly in the automatic mode to perform Navy wash formulas I, II, and III (see [Table 655-1-3](#)). Check manual operation of the hot and cold water inlet valves, booster heater, wash and extract motors, and drain valve.

Table 655-1-3 STANDARD NAVY WASH FORMULAS

FORMULA I AND II – WHITE COLORFAST COTTON, SYNTHETIC, AND BLENDED FABRICS, COLORED COTTON, SYNTHETIC, AND BLENDED FABRICS							
Step	Operation	Step Time	Descending Time	Water	Set Point/Temp Setting	Water Level Steam/Electric	Supplies
1	Break/Suds Drain	10 1	37 27	Hot	Set Pt. 2/130 Deg. F.	Low – 4”/8”	Detergent
2	Flush/Suds Drain	6 1	26 20	Hot	Set Pt. 2/130 Deg F.	Low – 4”/8”	
3	Extract	1.5	19				
4	Rinse Drain	3 1	18 15	Hot	Set Pt. 2/130 Deg F.	Low – 4”/8”	
5	Rinse Drain	3 1	14 11	Hot	Set Pt. 2/130 Deg F.	Low – 4”/8”	
6	Rinse Drain	4 1	10 6	C. Temp	Set Pt. 1/130 Deg F.	Low – 4”/8”	Sour Blue
7	Extract	4.5	5				
FORMULA III WOOLENS AND NONFAST COLORS							
Step	Operation	Step Time	Descending Time	Water	Set Point/Temp Setting	Water Level Steam/Electric	Supplies
1	Break/Suds Drain	5 1	31 26	Blend	Set Pt. 2/90 Deg F.	High – 9”	Detergent
2	Flush/Suds Drain	5 1	25 20	Blend	Set Pt. 2/90 Deg F.	High – 9”	
3	Extract	1.5	19				
4	Rinse Drain	3 1	18 15	Blend	Set Pt. 2/90 Deg F.	High – 9”	
5	Rinse Drain	3 1	14 11	Blend	Set Pt. 2/90 Deg F.	High – 9”	
6	Rinse Drain	4 1	10 6	C. Temp.	Set Pt. 1/90 Deg F.	High – 9”	Sour Blue
7	Extract	4.5	5				

655-1.9.7.4 Ensure that the hot water supply to the washer-extractor is between 120° to 140°F.

655-1.9.7.5 Ensure that the steam supply pressure to the steam booster heater is in accordance with the manufacturer's specifications.

655-1.9.7.6 Ensure that the cylinder is rotating in the same direction during low extract pick-up and when changing from low to high extract.

655-1.9.7.7 Ensure that braking after extraction is sufficient to lower cylinder revolutions per minute (rpm) before the energizing of the wash motor. Without sufficient braking, a sound like screeching tires will be heard due to the belts slipping on their sheaves, with the energization of the wash motor. This screeching represents accelerated belt wear and damaging over-torque of the wash and drive train parts.

655-1.9.7.8 Ensure that the appropriate washer-extractor indicator lights are lit during the various cycles and occurrences.

655-1.9.7.9 Ensure that all electrical panel enclosures are securely closed and locked.

655-1.9.7.10 Ensure that emergency stop and reset buttons are operable.

655-1.9.7.11 Ensure that service piping is not leaking.

655-1.9.7.12 Ensure that steam piping is properly lagged (if applicable).

655-1.9.7.13 Ensure that the temperature gauge and indicator is operable.

655-1.9.7.14 Ensure that oil reservoirs on gear reducers, air lubricators, etc. are full.

655-1.9.7.15 Ensure that the inner doors and loading door are securely locked during the operation of the washer-extractor.

655-1.9.7.16 On multi-pocket washer-extractors ensure proper operation of JOG function. Ensure the use of two hands are required to inch the cylinder to another cylinder door for loading and unloading.

655-1.9.7.17 During extraction, ensure that washer-extractor vibrations do not exceed 0.635 millimeter (mm) (0.025 inch) double amplitude (DA) on the washer- extractor's mounting flange and 0.254 mm (0.010 inch) DA on the deck 1.2 m (4 ft) away. Measure vibration levels with a properly calibrated mass vibration meter.

655-1.9.7.18 Manually trip the vibration limit switch to verify de-energization of the washer-extractor. After verification of the vibration limit switch operation, reset the vibration limit switch.

655-1.9.7.19 If the washer-extractor is designed with a cylinder basket balancing device, verify its correct operation.

655-1.9.7.20 Ensure that the washer-extractor is level on its foundation and no gaps exist between the equipment base and the foundation.

655-1.9.7.21 Ensure that nuts, bolts, and screws are tight on the washer-extractor and to the foundation.

655-1.9.7.22 Ensure that the cylinder latches on multi-pocket washer-extractors are operating properly and securely latch the cylinder doors closed.

655-1.9.7.23 Ensure that the low, high and safety water level settings are properly adjusted to the correct cylinder water level heights.

655-1.9.7.24 Ensure that the clutch is engaging and disengaging the wash motor properly.

655-1.9.7.25 Ensure that the wash reversal dwell time interval is 1 to 1.5 seconds.

655-1.9.7.26 Confirm good cylinder bearing condition.

655-1.9.7.27 Ensure that operation of the buzzer occurs at the end of the wash cycle.

655-1.9.7.28 Verify the installation of a plumbed eye wash station in close proximity to the chemical storage area. The eye wash station shall provide a 15 minute minimum flush time.

655-1.9.7.29 Ensure that gaskets around the main door and water level sightglass do not leak.

655-1.9.7.30 Ensure that the air regulator and lubricator are adjusted to the proper settings (see equipment technical manuals).

655-1.9.7.31 Ensure that the hot and cold water line pressure is 20 to 40 psi.

655-1.9.7.32 Verify the correct operation of the solenoid valves.

655-1.9.7.33 Verify the operation of the door sensor switch and door lock.

655-1.9.7.34 Verify the operation of the emergency stop button.

655-1.9.8 Different makes, commercial brands, and types of washer-extractors have slight variations in their principle operations. General washer-extractor operating steps are provided herein. For precise washer-extractor operating steps, the operator should review the Navy approved washer-extractor technical manual.

655-1.9.8.1 Ensure that all utilities are provided to the washer-extractor (that is, globe and gate valves opened, low pressure (LP) air system activated, and so forth).

655-1.9.8.2 Open outer shell door.

655-1.9.8.3 For multi-pocket machines turn on the main power switch and rotate the cylinder with the two jog buttons until the desired cylinder door lines up with the shell door opening. Open the cylinder door.

655-1.9.8.4 Load the washer-extractor. Do not exceed the rated capacity of the machine in order to insure adequate mechanical action, which is especially important when washing polyesters. Overloading will also contribute to excessive wrinkling. On multi-pocket washer-extractors, it is imperative that the load is evenly divided among the compartments. In order to divide the load evenly, each compartmental load should be separately weighed. Overloading or not evenly dividing the load between each compartment is one of the chief causes of equipment failures by producing forces not designed by the manufacturer. Overloading also results in poor wash quality by preventing proper mechanical action to remove soil.

655-1.9.8.5 Close the cylinder door on multi-pocket machine. Check the latch handles to ensure that they are securely inserted into the latch wells.

655-1.9.8.6 Close the shell door and tighten the door seal gasket against the shell. Do not overtighten.

655-1.9.8.7 Load proper amount of detergent into the automatic supply injection bin or manual supply bin and sour blue into the automatic supply injection bin.

655-1.9.8.8 On Class 2 machines select the desired formula and depress the start or resume button to begin the cycle. On Class 3 machines depress the desired formula button to begin the cycle.

655-1.9.8.9 After the washer-extractor completes the wash formula, unload the clothing. Transport clothing which is going to be pressed/finished to the finishing work stations. Transfer other permanent press clothing items to the tumbler-dryers for drying.

655-1.10 TUMBLER-DRYERS

655-1.10.1 Tumbler-dryers are composed of a heating medium (thermostatically controlled steam coils or electric heating elements to regulate the heating of the incoming airflow), a perforated revolving cylinder with lifting ribs (to hold and tumble clothing), a blower assembly (to draw air in, through, and out of the tumbler-dryer), and a pair of sweep sheets wrapped partially around the circumference of the cylinder (to direct the heated airflow through the clothing in the cylinder).

655-1.10.2 Tumbler-dryers with a load capacity of 50 and 100 pounds shall be manufactured in accordance with the following configurations:

Type I - Steam heated

Class A - 50 lb dry weight

Style 1 - Unsectionalized

Style 2 - Sectionalized

Class B - 100 lb dry weight

Style 1 - Unsectionalized

Style 2 - Sectionalized

Type II - Electrically heated

Class A - 50 lb dry weight

Style 1 - Unsectionalized

Style 2 - Sectionalized

655-1.10.3 The applicable essential characteristics for tumbler-dryers having a load capacity of 50 to 100 pounds, are described in the following paragraphs.

655-1.10.3.1 Sectionalized tumbler-dryers shall be constructed to be disassembled, transported and reassembled within the ship without hot work, such as welding and brazing. Major subassemblies that bolt together are preferred. Limiting dimensions for each major subassembly shall be 50 inches high, by 25 inches wide, by 36 inches deep. Subassemblies shall be match marked to assist in field reassembly.

655-1.10.3.2 Heating coils on Type I tumbler-dryers shall be constructed in accordance with ASME Boiler and Pressure Vessel Code, sections II and VIII. Heating elements on Type II tumbler-dryers shall be fin tube enclosed conduction type securely fastened in place.

655-1.10.3.3 A thermostatic control, which operates the steam solenoid valve or the electric heating coil shall be provided for manually setting two selected temperatures of 155 and 185°F. Separate indicator lights shall be provided which are illuminated during the drying cycle and while the steam solenoid valve or electric heating element is energized.

655-1.10.3.4 A timer shall be provided with a range of 0 to 60 minutes by which the operator can select the drying time.

655-1.10.3.5 A cooldown cycle shall automatically activate at the end of the drying cycle which cuts off heat to the machine and continue cylinder and blower rotation until the cylinder temperature is lowered to 135°F. An indicator light shall be provided which is illuminated for the duration of the cooldown cycle. An audible signal shall activate at the end of the cooldown cycle and continue until manually turned off.

655-1.10.3.6 In addition to the primary thermostatic control, backup safety heat sensors shall be provided in the exhaust duct of Type I and Type II tumbler-dryers and in the heating bonnet of Type II tumbler-dryers. Backup heat sensors shall interrupt steam flow or power to heating element should cylinder and exhaust temperatures exceed 230°F or if the electric heating element exceeds its maximum operating temperature.

655-1.10.3.7 An airflow sensor shall be installed on Type II tumbler-dryers to interrupt electric power to the heating element when air flow through the tumbler-dryer is insufficient to prevent garment scorching or damage to the electric heating elements due to excessive temperatures.

655-1.10.3.8 A lint screen shall be provided through which all of the air is exhausted. The screen shall be installed between the cylinder and the exhaust outlet. Access for cleaning the lint screen shall be from the front of the machine.

655-1.10.3.9 Excepting surfaces touched to operate the tumbler-dryer, the outer housing, door and other components shall be insulated from internal heat sources so that not more than 15 percent of the surface of the outer housing exceeds a temperature of 35°F above the ambient air temperature. Surfaces touched by the operator to operate the tumbler-dryer shall not exceed a temperature of 35°F above the ambient air temperature.

655-1.10.3.10 The machine shall operate on 440-volt, 60-hertz, 3-phase electrical system. The equipment shall conform to the recommended practices for electrical installation on board ship and shall be on an ungrounded electrical system. No grounds shall be permitted on the machine wiring. All wiring shall be contained within protective sleeves. All electrical panels, sleeves and fittings shall be drip proof. Electrical motor enclosures shall be dripproof or better.

655-1.10.3.11 Type I and Type II tumbler-dryers shall remove moisture from the maximum load capacity soaked with water to a wet weight of 150 percent of the maximum bone-dry weight. The tumbler-dryer shall remove 97 percent of the water from the load with a drying rate of 1.2 pounds of water per minute on Type I and 0.8 pounds of water per minute on Type II tumbler-dryers set at a drying temperature of 185°F.

655-1.10.3.12 The cylinder shall reverse within a range of four reversals per minute maximum to a minimum of one reversal per minute.

655-1.10.3.13 Tumbler-dryers shall met the applicable requirements for Type I environmental vibration as specified in MIL-STD-167-1.

655-1.10.3.14 Exposed belts, shafts, pulleys and other moving parts shall be fully enclosed by metal guards. Guards shall be firmly supported but readily removable for maintenance.

655-1.10.3.15 The base of the machine shall be fitted with not less than four bolt holes for anchoring the machine to a hull foundation.

655-1.10.3.16 The loading door shall be provided with an electric interlock to prevent or stop the rotation of the cylinder when the door is opened.

655-1.10.3.17 The machine shall function without reduction in performance when operating at angles of 12 degrees to each side of a vertical plane.

655-1.10.4 Tumbler-dryers having a load capacity of 16 to 20 pounds shall be manufactured in accordance with the following configurations:

Type I -	For submarines
Type II -	For surface ships

655-1.10.5 The applicable essential characteristics for tumbler-dryers having a load capacity of 16 to 20 pounds, are described in the following paragraphs.

655-1.10.5.1 Type I tumbler-dryers shall be constructed to be disassembled into sections or parts that can be passed through a 25-inch diameter submarine hatch and reassembled in the laundry space. Type II tumbler-dryers shall be constructed to be disassembled into sections or parts that can pass through a 26 by 66 inch watertight door and be reassembled in the laundry space. Separation and reassembly of parts by welding, riveting, cutting or similar means shall not be used to meet the disassembly requirement.

655-1.10.5.2 Heating unit on Type I tumbler-dryers shall be electric. Heating elements shall be of the fin tube enclosed conduction type. Heating unit on Type II tumbler-dryers shall be electric or continuous closed loop steam coil in accordance with ASME Boiler and Pressure Vessel Code, sections II and VIII.

655-1.10.5.3 Excepting surfaces touched to operate the tumbler-dryer, the outer housing, door and other components shall be insulated from internal heat sources so that not more than 15 percent of the surface of the outer housing exceeds a temperature of 35°F above the ambient air temperature. Surfaces touched by the operator to operate the tumbler-dryer shall not exceed a temperature of 35°F above the ambient air temperature.

655-1.10.5.4 The overall maximum dimensions of the tumbler-dryer shall not exceed 40 inches deep, 26-1/2 wide, and 40 inches high.

655-1.10.5.5 A temperature controller shall control the air within the drying chamber. The controller shall be variable from a minimum setting of approximately 130°F to a maximum setting of 185°F. A temperature indicator shall be provided for observation of the actual drying temperature.

655-1.10.5.6 A timer shall be provided to control the length of the drying cycle with a variable setting from 0 to 60 minutes. The timer shall incorporate an automatic cooldown cycle by either de-energizing the heating element for the last 5 minutes of the drying cycle or at timer completion, thermostatically control tumbler-dryer cooldown until the temperature drops to 135° before ending the drying cycle.

655-1.10.5.7 In addition to the primary thermostatic control, backup heat sensors shall be provided in the exhaust duct of steam and electrically heated tumbler-dryers and in the heating bonnet of electrically heated tumbler-dryers. Backup heat sensors shall interrupt steam flow or power to heating element should cylinder and exhaust temperatures exceed 230°F or if the electric heating element exceeds its maximum operating temperature.

655-1.10.5.8 An airflow sensor shall be installed on electrically heated tumbler-dryers to interrupt electric power to the heating unit when air flow through the tumbler-dryer is insufficient to prevent garment scorching or damage to the electric heating elements due to excessive temperatures.

655-1.10.5.9 The tumbler-dryer shall remove moisture from the maximum load capacity soaked with water to a wet weight of 150 percent of the maximum bone-dry weight. The tumbler-dryer shall remove 95 percent of the water from the load with a drying rate of 0.4 pounds of water per minute.

655-1.10.5.10 Exposed belts, shafts, pulleys and other moving parts shall be fully enclosed by metal guards. Guards shall be firmly supported but readily removable for maintenance.

655-1.10.5.11 The loading door shall be provided with an electric interlock to prevent or stop the rotation of the cylinder when the door is opened.

655-1.10.5.12 A lint screen shall be provided through which all of the air is exhausted. The screen shall be installed between the cylinder and the exhaust outlet. Access for cleaning the lint screen shall be from the front of the machine.

655-1.10.5.13 The tumbler-dryer shall be capable of operating at angles of inclination up to 30 degrees for Type I dryers and 12 degrees for Type II dryers.

655-1.10.5.14 The base of the machine shall be fitted with not less than four bolt holes for anchoring the machine to a hull foundation.

655-1.10.5.15 The machine shall operate on 440-volt, 60-hertz, 3-phase electrical system. The equipment shall conform to the recommended practices for electrical installation on board ship and shall be on an ungrounded electrical system. No grounds shall be permitted on the machine wiring.

655-1.10.6 Tumbler-dryers shall be installed in accordance with the following requirements:

655-1.10.6.1 Service piping shall contain a flexible section of hose 14 to 18 inches in length installed between the ship's service piping and the tumbler-dryers (see **NSTM Chapter 505, Piping Systems**).

655-1.10.6.1.1 Steam supply and condensate lines shall be composed of extruded or convoluted tetrafluoroethylene hose with stainless steel (CRES) braided reinforcement and threaded end couplings. Steam supply and condensate flexible hose assemblies shall be in accordance with the Society of Automotive Engineers (SAE) AS604 or AS620 specifications and Naval Ship's Technical Manual S6430-AE-TED-010.

655-1.10.6.2 The design of the foundation shall use metal to metal attachment of the tumbler-dryers to the foundation.

655-1.10.6.3 Posting of safety and operational placards ([Figure 655-1-2](#)) shall be provided in the vicinity of the tumbler-dryers or groups of dryers.

TUMBLER-DRYER

WARNING

THIS MACHINE SHALL BE OPERATED BY QUALIFIED PERSONNEL ONLY. SERIOUS PERSONNEL AND EQUIPMENT HAZARDS EXIST DURING THE OPERATION OF THE MACHINE. DO NOT BYPASS OR DISCONNECT ANY SAFETY FEATURE SUCH AS THERMOSTATS, AIR FLOW SENSOR OR DOOR SWITCH. REMOVE FINISHED LOAD FROM DRYER PROMPTLY. SPONTANEOUS COMBUSTION OF EXCESSIVE TEMPERATURES, EXCESSIVE AND RESIDUAL SOAP OR DETERGENTS, RESIDUAL OILS AND GREASE OR BUILD-UP OF STATIC CHARGE IN SYNTHETIC FABRICS. CLEAN PRIMARY LINT FILTERS EVERY 2 HOURS OF OPERATION AND SECONDARY LINT FILTERS EVERY 8 HOURS OF OPERATION AND AT THE END OF THE WORK DAY. DO NOT LEAVE THE SPACE UNATTENDED WHILE THE MACHINE IS IN OPERATION.

OPERATING INSTRUCTIONS

1. VERIFY POWER AND VENTILATION IS TURNED ON AND STEAM VALVES ARE OPENED AS APPLICABLE.
2. ACCOMPLISH ALL LOADS IAW STANDARD NAVY WASH FORMULAS. LOAD DRYER WITH THE PROPER AMOUNT OF LAUNDRY. CLOSE DOOR AND VERIFY LATCH IS SECURE.
3. SET DRYING TIME TO APPROXIMATELY 25-30 MINUTES.
4. ON MACHINES WITHOUT A AUTOMATIC COOLDOWN CYCLE SET COOLDOWN TIME TO 5-10 MINUTES. DO NOT UNDER ANY CIRCUMSTANCES BY-PASS THE COOLDOWN CYCLE WHICH IS REQUIRED TO REMOVE RESIDUAL HEAT AND ALSO PROLONGS THE LIFE OF ELECTRIC HEATING ELEMENTS.
5. SET DRYING TEMPERATURE TO SUIT MATERIAL BEING DRIED. DO NOT EXCEED 185 DEGREES.
6. SET DAMPERS IF APPLICABLE.
7. START DRYER. DEPRESS START BUTTON OR PLACE THE DOOR SAFETY BAR IN THE ON POSITION AS APPLICABLE.
8. ALLOW DRYER TO RUN THROUGH FULL CYCLE INCLUDING COOL DOWN. PERIODICALLY MONITOR THE DRYER OPERATION AND INFORM THE LAUNDRY SUPERVISOR OF ANY ABNORMAL OPERATION. DO NOT CONTINUE TO OPERATE A DRYER IF THE TEMPERATURE EXCEEDS 200 DEGREES OR IF THE COOL DOWN CYCLE IS NOT REDUCING TEMPERATURE TO APPROXIMATELY 135 DEGREES AT CYCLE END.
9. UNLOAD CLOTHES PROMPTLY AT END OF CYCLE. MANUALLY FLUFF CLOTHES WHILE UNLOADING TO REMOVE RESIDUAL HEAT.

Figure 655-1-2 Operational and Safety Placard, Tumbler-Dryers

655-1.10.6.4 Tumbler-dryers installed with steam condensate lines shall use an orifice assembly. The strainer in the orifice assembly shall be installed upstream or in front of the orifice plate. The steam condensate lines should have a y-strainer installed upstream from the orifice and a stop check valve installed downstream from the orifice. The inlet steam connection shall come off the top of the steam header.

655-1.10.6.5 When practical, and in particular on smaller ships, tumbler-dryers should be installed so that the axis of the cylinder rotation is fore-and-aft. Tumbler-dryers shall be arranged directly side by side in numbers not to exceed three, in order to ensure maintenance and repair access to the rear of the tumbler-dryers.

655-1.10.6.6 The air quantity for the ship's exhaust terminal connection to the tumbler-dryers shall not be less than 150 percent of the tumbler-dryer's fan capacity. The exhaust duct from each tumbler-dryer shall be outfitted with a 40 mesh secondary lint bag or a lint arrester should be installed for the tumbler-dryer complement (see Puget Sound Drawing 501-2423206). An exhaust duct terminal or terminals shall be located in the overhead at the rear of the tumbler-dryers to exhaust the lost heat from the heating coils and the open secondary lint bag screen exhaust terminals. Ventilation supply blast-type terminals shall be located in the overhead at the front of the tumbler-dryers. Ventilation ducting shall be arranged to allow for the replacement of the steam or electric heating element coils, replacement of electric motors, bearings, access into the front electrical control panel box, and so forth.

655-1.10.7 In order to ensure safe and proper tumbler-dryer operation the following installation and operational check-out procedures are recommended:

655-1.10.7.1 Ensure that the gear reducer is full of the specified oil and is properly vented.

655-1.10.7.2 Ensure that drive belts are adjusted to the correct tension. The ideal belt tension is the lowest tension at which the belt will not slip under peak load conditions. Over tensioning of belts shortens belt and bearing life. Check belts for wear and alignment.

655-1.10.7.3 If the tumbler-dryer is manufactured with chains and sprockets, inspect them for wear and alignment.

655-1.10.7.4 Ensure that safety guards are in place.

655-1.10.7.5 Ensure that the door safety interlock de-energizes the cylinder motor when the cylinder door is opened.

655-1.10.7.6 Ensure that steam pressure to steam heated tumbler-dryers is 100 psi and the condensate line is not plugged.

655-1.10.7.7 Ensure that 14 to 18 inches of flexible teflon convoluted or extruded steam hose assemblies with CRES braid are installed and are in good condition on the steam inlet and condensate lines and properly tagged.

655-1.10.7.8 Hydrostatically test the steam coils on steam heated tumbler-dryers at 150 psi for 5 minutes. Electrically test the resistance of the electrical heating elements on the electrically heated tumbler-dryers.

- 655-1.10.7.9 Ensure that the service steam piping on steam heated tumbler-dryers is not leaking.
- 655-1.10.7.10 Ensure that the service steam piping on steam heated tumbler-dryers is properly lagged.
- 655-1.10.7.11 Inspect electrical wiring for chaffing or loose connections.
- 655-1.10.7.12 Ensure that the appropriate indicator lights are lit during the drying cycle.
- 655-1.10.7.13 Ensure that all temperature gauges bear valid calibration stickers and function properly.
- 655-1.10.7.14 Ensure that the cooldown operation de-energizes the heating element unit (electric or steam) and cools the cylinder automatically to approximately 135°F.
- 655-1.10.7.15 Ensure that the drying timer is operational and adjustable from 0 to 60 minutes.
- 655-1.10.7.16 Ensure that the steam solenoid operates properly on steam heated tumbler-dryers.
- 655-1.10.7.17 Ensure that the buzzer sounds at the end of the drying cycle.
- 655-1.10.7.18 Ensure that the primary lint screen is in place and is in good condition.
- 655-1.10.7.19 Ensure that the secondary lint trap or lint arrester is installed and is clean of lint.
- 655-1.10.7.20 Ensure that the cylinder basket is properly aligned and has no interior damage.
- 655-1.10.7.21 Verify correct thermostat operation.
- 655-1.10.7.22 Ensure that the loading door latches close and the door gasket provides a tight fit against the tumbler-dryer cabinet.
- 655-1.10.7.23 Inspect the drum and fan support bearings for wear.
- 655-1.10.7.24 If the tumbler-dryer is supplied with air dampers, check that they properly work in deflecting air-flow through or around the heating coils.
- 655-1.10.7.25 Ensure that the fan/blower assembly is rotating in the proper direction.
- 655-1.10.7.26 Ensure that cylinder basket reversal is between one to four times per minute with proper dwell time between reversals (that is, cylinder basket stops rotating before re-energization of the drive motor for the opposite rotation). Tumbler-dryer should be fully loaded to verify the proper dwell time setting.
- 655-1.10.7.27 Ensure dust and lint deposits are removed from the heating element coils.

655-1.10.8 Different makes, commercial brands, and types of tumbler-dryers have slight variations in their principle operations. Initial start-up and general tumbler-dryer operating steps are provided herein. For precise tumbler-dryer operating steps, the operator should review the Navy approved tumbler-dryer technical manual.

655-1.10.8.1 Check the secondary lint trap or lint arrester for lint; clean if necessary. During normal operations the secondary lint filter or lint arrester shall be cleaned every 8 hours and at the end of the work day.

655-1.10.8.2 Check the primary lint trap within the tumbler-dryer(s) for lint; clean if necessary. During normal operations the primary lint filter shall be cleaned every 2 hours and at the end of the work day.

655-1.10.8.3 Energize the ship's exhaust ventilation system which is connected to the tumbler-dryer(s).

655-1.10.8.4 On steam heated tumbler-dryers, open the steam condensate line valves. Verify steam inlet valve is closed.

655-1.10.8.5 Set timer for 5 minutes.

655-1.10.8.6 Set thermostat at the maximum temperature of 185°F.

655-1.10.8.7 If tumbler-dryer is equipped with dampers, set them on hot.

655-1.10.8.8 Slightly crack open the steam inlet line.

655-1.10.8.9 Push the start button to energize the tumbler-dryer.

655-1.10.8.10 Slowly open the steam inlet line during the 5 minute dry cycle. If too much steam is emitted to the tumbler-dryer at once, the copper piping in the steam coil will expand rapidly and any remaining condensate will flash to steam and cause damaging steam piping hammer.

655-1.10.8.11 Cancel buzzer at the end of the preheat cycle by opening and closing the loading door.

CAUTION

Never leave the laundry space unattended while tumbler-dryers are in operation.

WARNING

Fire hazard potentials exist during the drying process. The maximum drying temperature setting should not exceed 185°F. Lint must be removed to prevent a reduction of airflow through the tumbler-dryer. A 135°F cooldown

Warning - precedes

operation is required to remove residual heat and manual fluffing during the unloading process is also required to remove residual heat.

655-1.10.8.12 Load the tumbler-dryer with clothing from the washer-extractor. The amount of clothing to be loaded into a tumbler-dryer shall not exceed the weight capacity of the tumbler-dryer using clothing/garment dry weight.

655-1.10.8.13 Close the loading door.

655-1.10.8.14 Set timer for proper drying time (approximately 30 to 40 minutes). The proper drying time is dependent on the type of clothing being dried and the load size.

655-1.10.8.15 Set the thermostat at the proper drying temperature which is dependent on the type of clothing being dried. The drying temperature should not be set above 185°F.

655-1.10.8.16 If the tumbler-dryer is equipped with dampers, set them on hot.

655-1.10.8.17 On tumbler-dryer without automatic timed/temperature controlled cooldown, set the cooldown timer for 10 minutes.

655-1.10.8.18 Push the start button to energize the tumbler-dryer.

655-1.10.8.19 Routinely check the temperature gauge on the tumbler-dryer during the drying cycle to ensure drying temperature does not exceed 200°F. If drying temperatures exceed 200°F, the space supervisor should be notified for immediate corrective action. A tumbler-dryer operating above 200°F is a serious fire hazard and should not be operated.

655-1.10.8.20 At the completion of the drying cycle the cooldown process should bring the tumbler-dryer temperature to 135°F or less. If the cooldown cycle does not cool down automatically or during a set 10 minute cooldown time interval, notify the space supervisor for immediate action. A tumbler-dryer operating without cooldown may produce conditions allowing for spontaneous combustion of garments after the drying process.

655-1.10.8.21 After the buzzer sounds at the end of the cooldown cycle, unload the tumbler-dryer. Promptly remove tumbler-dryer loads and manually fluff to remove residual heat. Residual heat can produce spontaneous combustion under certain conditions.

655-1.10.8.22 At the end of the work day, secure steam inlet and condensate valves on steam heated tumbler-dryers.

655-1.11 LAUNDRY PRESSES AND FINISHING EQUIPMENT

655-1.11.1 A laundry press is composed of two heated pressing surfaces. The top pressing surface, the head, is the moving surface. The pressing surface of the head is a highly polished concave metal plate. The lower pressing surface, the buck, is a convex stationary surface covered with a mesh/spring base pad, two layers of flannel

and an outer cover cloth. The movement of the head to the buck pressing surface is done using pneumatics and mechanical linkages. The shape of the head and buck allows the operator to press a garment efficiently to a desired finish. Pressing of the garment is done while the garment is damp (creases, folds, and wrinkles are relaxed). The laundry press applies high heat and pressure on the garment's fibers to dry, straighten and set the finish. The padding on the press must be kept resilient to achieve quality finishing results while preventing damage to items like buttons and zippers on the garments. A laundry press is designed to press cotton and cotton blend garments with high heat and pressure. Using ordinary pressing techniques to press polyester synthetics and wool garments on a laundry press will result in permanent damage to the garment due to the application of high temperature heat. Polyester synthetics and wool garments can be pressed on a laundry press at reduced temperatures. However, the pressing of wool and polyester synthetics should be accomplished on a dry cleaning press whenever possible since a laundry press will not provide the desired quality and requires a special pressing technique.

655-1.11.2 A flatwork ironer consists of a revolving steam heated cylinder against which the flatwork (bed and table linen) is pressed using a padded pressure roller. The flatwork is delivered to the flatwork ironer damp for finishing. The flatwork is fed into the front of the flatwork ironer and feed ribbons lead the flatwork over the heated cylinder. At the rear of the flatwork ironer return ribbons press the flatwork against the underside of the heated cylinder and returns the flatwork to the front of the flatwork ironer onto a metal table. The drive/feed rate on the flatwork ironer is adjusted so that the flatwork is adequately dried and finished during the ironing process.

655-1.11.3 Laundry presses shall be manufactured in accordance with the following configurations:

Type I - Laundry presses, steam heated.

Class B - Trouser topping, double.

Class C - General utility

Type II - Laundry presses, electrically heated.

Class B-E - Trouser topping, double.

Class C-E - General utility

Type III - Flatwork ironer, cylinder

Class A - 85-inch ironer

Class B - 60-inch ironer

655-1.11.4 The applicable essential characteristics of laundry presses and flatwork ironers are described in the following paragraphs:

655-1.11.4.1 Laundry press frame shall be of malleable iron or steel finished for corrosion resistance. Gray cast iron or other brittle material shall not be used for structural parts or strength members.

655-1.11.4.2 Flexible steam hose assemblies shall be extruded or convoluted tetrafluoroethylene hose with stainless steel wire braid and end fittings in accordance with SAE AS604 or AS620. Exposed steam hoses shall be sheathed to prevent the operator or maintenance personnel from incidental contact that might result in burn accidents.

655-1.11.4.3 Exposed pulleys, gears, springs, cams, rollers and other moving parts shall be fully enclosed and guarded to prevent contact with personnel. Provisions shall be made to readily remove guards over parts requiring adjustment and maintenance.

655-1.11.4.4 The base of the machine shall be fitted with not less than four bolt holes for anchoring the machine to a hull foundation.

655-1.11.4.5 Type I laundry presses shall be steam heated and conform to the ASME Boiler and Pressure Vessel Code, section VIII. Type II laundry press shall be electrically heated by sheathed, electrical strip heating elements. Type III flatwork ironer steam cylinder shall conform to the ASME Boiler and Pressure Vessel Code.

655-1.11.4.6 Laundry presses shall be sectionalized to allow the disassembly of the laundry presses into several subassemblies. A sectionalized laundry press allows the laundry press subassemblies to be transported through a shipboard standard 26 inch x 66 inch watertight door for reassembly and installation within the laundry space without the need to cut a hull access.

655-1.11.4.7 Means shall be provided for automatically adjusting the head and/or buck to conform to varying thicknesses of the garments being pressed and to accommodate buck padding shrinkage.

655-1.11.4.8 The press head shall return to the open position when the low pressure (LP) air is turned-off.

655-1.11.4.9 In case of an obstruction between the head and the padded buck of 3/4 inch or greater, or if the safety control bar comes in contact with same obstruction, the moving member shall not lock closed, and upon release of one or more of the closing buttons, the head shall release to the open position. This prevents the laundry press from crushing and burning the operator's hands and arms if caught between the head and buck during the closing operation.

655-1.11.4.10 The laundry press shall be pneumatically operated. Movement of the press head shall be controlled by two manual operated push buttons located not less than 10 inches apart, recessed, and arranged so that both controls must be operated simultaneously, requiring the use of both hands, during the entire closing and locking operation. Upon releasing one or both controls prior to the head reaching the closed position, the head shall return automatically and promptly to the open position.

655-1.11.4.11 A finished, metal work table shall be provided under the buck.

655-1.11.4.12 The buck thermostat on electrically heated laundry presses shall have a maximum temperature setting of 275°F to keep the buck padding dry and to achieve quality finishing results.

655-1.11.4.13 The head thermostat on electrically heated laundry presses shall have a maximum temperature setting of 320°F to achieve quality finishing results without damaging the garment fibers under high heat.

655-1.11.4.14 An air regulator and gauge shall be installed on the LP air supply line of each laundry press. Correct and constant LP air pressure must be provided to the laundry press to maintain proper operation.

655-1.11.4.15 Type II and Type III equipment shall operate on 440-volt, 60-hertz, 3-phase electrical system. The equipment shall conform to the recommended practices for electrical installation on board ship and shall be on an ungrounded electrical system. No grounds shall be permitted on the equipment wiring.

655-1.11.4.16 The drive rate of Type III flatwork ironers shall be adjustable from 16 to 36 feet per minute to provide proper finishing of different fabrics.

655-1.11.4.17 A finger safety guard shall be provided on Type III flatwork ironers to prevent operator entanglement with the drive mechanism.

655-1.11.5 Laundry presses and flatwork ironers shall be installed in accordance with the following requirements:

655-1.11.5.1 The foundation shall be reasonably level and flat to ensure metal to metal attachment of the laundry press or flatwork ironer to the foundation.

655-1.11.5.2 Posting of safety and operational placards are required at each press station and flatwork ironer ([Figure 655-1-3](#) and [Figure 655-1-4](#)).

LAUNDRY PRESS/ELECTRIC DRY CLEANING PRESS

WARNING

THIS EQUIPMENT SHALL BE OPERATED BY QUALIFIED PERSONNEL ONLY. SERIOUS PERSONNEL AND EQUIPMENT HAZARDS EXIST DURING THE OPERATION OF THE PRESS. DO NOT BYPASS OR DISCONNECT ANY SAFETY FEATURE SUCH AS THE DUAL CLOSING BUTTONS, SAFETY BAR AND HEAD LOCKING MECHANISM. DO NOT OVERRIDE TWO HAND OPERATION.

OPERATING INSTRUCTIONS

- 1. PRIOR TO OPERATING THE PRESS ENSURE PROPER STEAM PRESSURE OF 100 PSI OR HEAD AND BUCK THERMOSTAT SETTINGS OF 310°F AND 270°F RESPECTIVELY. ON ELECTRICALLY HEATED DRY CLEANING PRESSES WITH HEAD GRID PLATE ENSURE THERMOSTAT SETTINGS OF 270°F. ADJUST AIR PRESSURE TO 80 PSI.**
- 2. INSPECT PADDING. PADDING SHOULD BE 3/4 TO 1 INCH DEEP, RESILIENT, CLEAN AND NOT EXCESSIVELY WORN. PADS SHOULD BE CHANGED BI-MONTHLY AND COVERS WASHED WEEKLY.**
- 3. LAY GARMENT ON BUCK.**
- 4. LOWER PRESS HEAD BY DEPRESSING BOTH CLOSING BUTTONS SIMULTANEOUSLY UNTIL THE HEAD IS CLOSED AND LOCKED. RELEASING ONE OR BOTH BUTTONS ON THE DOWN STROKE WILL RELEASE THE HEAD TO THE OPEN POSITION.**
- 5. DO NOT LEAVE PRESS UNATTENDED WHILE GARMENT IS IN THE PRESS AND THE HEAD IS IN THE CLOSED POSITION.**
- 6. AFTER THE GARMENT HAS BEEN PROPERLY PRESSED RELEASE THE HEAD BY EITHER DEPRESSING THE OPEN BUTTON OR LIFTING UP ON THE SAFETY RELEASE BAR.**
- 7. REPEAT ABOVE STEPS FOR THE REMAINING LAYS.**
- 8. AFTER GARMENT IS COMPLETELY PRESSED REMOVE AND HANG AS SOON AS POSSIBLE.**

Figure 655-1-3 Operational and Safety Placard, Laundry Press/Electric Dry Cleaning Press

OPERATING INSTRUCTIONS AND SAFETY PRECAUTIONS

FLATWORK IRONER

WARNING

THIS EQUIPMENT SHALL BE OPERATED BY QUALIFIED PERSONNEL ONLY. SERIOUS PERSONNEL AND EQUIPMENT HAZARDS EXIST DURING THE OPERATION OF THE PRESS. DO NOT BYPASS OR DISCONNECT ANY SAFETY FEATURE. DO NOT OPERATE IRONER IF FINGER SAFETY BAR IS NOT OPERATIONAL OR IF WIRE SAFETY GUARDS ARE NOT IN PLACE. NEVER ATTEMPT TO REMOVE AN ARTICLE ONCE IT BEGINS TO PASS THROUGH ROLLERS. IF AN ARTICLE BECOMES BOUND OR TANGLED TURN OFF THE MACHINE AND LOOSEN THE ROLLERS. DO NOT ATTEMPT TO REMOVE THE ARTICLE WHILE THE IRONER IS RUNNING.

OPERATING INSTRUCTIONS

- 1. VERIFY POWER IS TURNED ON. ENSURE COMPRESSION ROLLER IS DISENGAGED AND SPEED CONTROL IS SET AT SLOWEST SETTING. ENSURE IRONER IS PROPERLY WAXED AND IS CLEAR OF OBSTRUCTIONS AND FOREIGN OBJECTS.**
- 2. START FLATWORK IRONER BY DEPRESSING START BUTTON.**
- 3. VERIFY OPERATION OF FINGER SAFETY BAR AND ENSURE IRONER SHUTS OFF. RESTART AFTER VERIFYING PROPER OPERATION.**
- 4. SLOWLY OPEN STEAM VALVE. GRADUALLY ALLOW STEAM TO ENTER CYLINDER. THE IRONER WILL TAKE APPROXIMATELY 30 MINUTES TO REACH PROPER IRONING TEMPERATURES (300-400°F).**
- 5. ENGAGE COMPRESSION ROLLER BY STEPPING ON FOOT PEDAL.**
- 6. BEGIN PROCESSING FLATWORK. PLACE FABRIC ON FRONT CONVEYER. FABRIC WILL BE TAKEN UNDER DOFFER ROLLER, FINGER SAFETY BAR AND INTO CONTACT WITH THE HEATED CYLINDER AND COMPRESSION ROLLER.**
- 7. CONTINUE TO PROCESS FABRICS IN A SEQUENCE OF FEEDING, FOLDING AND STACKING. USE THE ENTIRE LENGTH OF THE HEATED ROLLER. ADJUST OPERATING SPEED AS NECESSARY.**
- 8. AFTER COMPLETION, SECURE FLATWORK IRONER BY RAISING COMPRESSION ROLLER, SECURE STEAM AND ALLOW IRONER TO CONTINUE TO OPERATE FOR APPROXIMATELY 20-30 MINUTES TO ALLOW THE HEATED CYLINDER AND OTHER ROLLERS AND COMPONENTS TO PROPERLY COOL DOWN.**

Figure 655-1-4 Operational and Safety Placard, Flatwork Ironer

655-1.11.5.3 Laundry presses and flatwork ironers installed with steam condensate lines shall use an orifice assemble. The strainer in the orifice assembly shall be installed upstream or in front of the orifice plate. The steam condensate lines should have a y-strainer installed upstream from the orifice and a stop check valve installed downstream from the orifice.

655-1.11.5.4 A ventilation exhaust hood shall be installed on each laundry press head and flatwork ironer to remove heat generated by the equipment at a rate of 500 cubic feet per minute.

655-1.11.6 In order to ensure safe and proper finishing operations the following installation and operational check-out steps are recommended:

655-1.11.6.1 Ensure that the inspection covers and access panels are securely in place.

655-1.11.6.2 Ensure that the laundry press air pressure is properly adjusted. The proper LP air pressure setting for the laundry press can be located in the equipment technical manual.

655-1.11.6.3 Ensure that the laundry press head and buck and the flatwork ironer heated cylinder heat up properly and maintains an even temperature across the pressing surfaces.

655-1.11.6.4 Ensure that the steam pressure to the steam heated laundry presses and flatwork ironer is maintained between 80 to 125 psi.

655-1.11.6.5 Ensure that the steam and LP air service piping is not leaking.

655-1.11.6.6 Ensure that the steam piping is properly lagged.

655-1.11.6.7 Ensure that the closing speed of the laundry press head is smooth. The laundry press closing speed and smoothness of operation can be changed by adjusting the needle valve and shock absorber respectively.

655-1.11.6.8 Ensure that the 3/4 inch safety non-locking feature or safety bar is operable on the laundry presses.

655-1.11.6.9 Ensure that the laundry press shock absorber/snubber is filled with oil. Ensure the flatwork ironer grease and oil cups, and gear reducer oil reservoirs are filled.

655-1.11.6.10 Ensure that there is 3/4 to 1 inch of resilient padding on the laundry press buck. Ensure that the padding on the flatwork ironer compression roller is resilient.

655-1.11.6.11 Ensure that a laundry press buck cover is installed over the padding with the correct side out. The buck cover must be clean, not worn, and held tightly in place by the draw string and springs.

655-1.11.6.12 Ensure the flexible hose from the laundry press head ventilation hood to the exhaust ductwork is connected and in good condition.

655-1.11.6.13 Ensure that the laundry press head and buck and flatwork ironer feed and return ribbons and compression roller covering are free of grim, dirt, and scratches. The grim, dirt, and scratches can be removed from the press head using a mild detergent solution or "EZ-OFF" and a fine mesh copper or brass scouring pad while the press head is warm.

655-1.11.6.14 Ensure that the press head is properly waxed using hot flaked paraffin wax or "Hot-Head Press Lube". Waxing must be accomplished while the press head is hot. Waxing of the flatwork ironer heated cylinder shall be in accordance with the equipment technical manual.

655-1.11.6.15 Hydrostatically test the steam heated laundry press head and buck and flatwork ironer at 150 psi for 5 minutes. Ensure that there is no pressure drop during the 5 minute time interval.

655-1.11.6.16 Ensure the feed rate adjustment of the flatwork ironer is smooth. Ensure smooth activation of the padded compression roller onto the heated cylinder.

655-1.11.6.17 Ensure that the flatwork ironer finger safety guard is operating properly. The guard shall deactivate the ironer when engaged.

655-1.11.7 Different makes and types of laundry presses have slight variations in their principle operations. General laundry press operating steps are provided herein. For precise laundry press operating steps, the operator should review the Navy approved technical manual and NAVEDTRA 10293.

655-1.11.7.1 Open the steam supply and condensate return line valves on steam heated laundry presses and energize electrically heated laundry presses. Heating time for the laundry press is 20 to 30 minutes.

655-1.11.7.2 If necessary, wax the laundry press head surface when the head becomes hot.

655-1.11.7.3 Open the LP air supply line and check the air pressure gauge on the laundry press. Adjust the laundry press air regulator to the appropriate LP air pressure setting for the laundry press.

655-1.11.7.4 Close the press head by depressing both recessed buttons simultaneously. Adjust the laundry press head closing speed and smoothness by adjusting the air needle valve and shock absorber respectively.

655-1.11.7.5 Determine the number of press lays required to press the garment or garments.

655-1.11.7.6 Determine the logical sequence of press lays to efficiently press the garment or garments.

655-1.11.7.7 Lay the garment or garments on the buck pressing surface.

655-1.11.7.8 Use the water spray gun to moisten the garment on the buck pressing surface. Garments must be damp in order to achieve quality pressing results in a timely manner.

655-1.11.7.9 Simultaneously depress both closure buttons to close the laundry press head to the buck pressing surface.

655-1.11.7.10 Closure time of the laundry press is roughly 15 seconds, however the actual pressing time depends on the material and the dampness of the garment being pressed.

655-1.11.7.11 Open the laundry press using the opening release button or bar.

655-1.11.7.12 Repeat the above steps until the garment or garments are finished.

655-1.11.8 Different makes and types of flatwork ironers have slight variations in their principle operations. General flatwork ironer operating steps are provided herein. For precise operating steps, the operator should review the Navy approved technical manual and NAVEDTRA 10293.

655-1.11.8.1 The compression roller shall be disengaged from the heated cylinder prior to start-up.

655-1.11.8.2 Slowly open the steam valve and energize the flatwork ironer drive mechanism. Heating time is 20 to 30 minutes.

655-1.11.8.3 Waxing of the flatwork ironer shall be accomplished after the flatwork ironer is hot. The waxing procedure can be found in the equipment technical manual.

655-1.11.8.4 Engage the compression roller onto the heated cylinder.

655-1.11.8.5 Feed the damp flatwork edge into the flatwork ironer.

655-1.11.8.6 If the flatwork is damp upon it's return, lower the flatwork ironer's feed rate speed.

655-1.11.8.7 Repeat above steps working up and down the entire length of the flatwork ironer when finishing flatwork.

655-1.11.8.8 During off workload periods the compression roller should be disengaged from the heated cylinder.

655-1.11.8.9 At the end of the work day the steam valve should be closed and the flatwork ironer allowed to cooldown before deenergizing the drive mechanism.

655-1.12 DRY CLEANING MACHINE

655-1.12.1 The dry cleaning process is performed on garments which are damaged by, or do not clean well by washing in water with detergent and drying at high temperatures. The dry cleaning washing process uses charged synthetic perchloroethylene (dry cleaning solvent) to clean these fabrics. The dry cleaning machine performs three major functions to accomplish the dry cleaning process: washing, extracting, and drying. The machine is automatically operated by means of a electro-mechanical card/timer controller or microprocessor. The most convenient program is a single filtered bath with distillation. The dry cleanable garments are loaded into a cylindrical basket which will rotate inside a tub when in operation. Once the main door is secured, dry cleaning solvent is pumped into the cylindrical basket passing through a set of filter units which exist in the machine to remove any impurities residing in the solvent. The garments are then cleaned by mechanical and chemical action during the wash cycle. When the solvent level for the wash process is reached, the base tank valve closes and solvent

is continually circulated through the filters and basket. After the wash process the dry cleaning machine drains the solvent from the cylinder back into the base tank and enters the extract process. The extraction of dry cleaning solvent from the garment is performed by the centrifugal force created by increased rotational speed of the basket. After the extraction process, the dry cleaning garments are tumbled dried with heat. Heat is created by activation of a heat pump refrigeration system and supplemental steam coil sending heated air into in the cylinder. The heat vaporizes the dry cleaning solvent and the vapor is drawn-off to a recovery housing where it is passed through a refrigerated coil and is recondensed to a liquid. The liquid then passes through a water separator on its way to the base tank. The dry cleaning garments are then removed from the cylinder for finishing work. During the process solvent is introduced into the still automatically via the program card. The distilling process eliminates dyes and other impurities that carbon core filtering elements are unable to remove from the dry cleaning solvent. The distilling process vaporizes the solvent by indirect steam heating leaving the impurities behind in the still which must be periodically cleaned.

655-1.12.2 Dry cleaning machines shall be completely self-contained with combination washer-extractor-dryer, closed circuit refrigeration-heat pump solvent recovery system, still, filters, solvent storage tanks, vapor containment system, button trap, water separator and automatic formula control unit. The load capacity shall be 20 pounds.

655-1.12.2.1 The dry cleaning machine shall comply with the applicable EPA National Emission Standard for Hazardous Air Pollutants and the OSHA permissible exposure limits for perchloroethylene as applicable to afloat units.

655-1.12.3 The applicable essential characteristics for dry cleaning machines having a load capacity of 20 pounds are described in the following paragraphs:

655-1.12.3.1 The automatic formula control unit shall be of the card program/ timer type or microprocessor. The control unit shall automatically control the machine through a complete cycle of fill, wash, drain, extract, dry, deodorize, filter and distill.

655-1.12.3.2 The refrigeration unit shall be water cooled of the combination condenser/receiver type. The compressor shall be hermetically sealed and the system shall be fitted with a means of discharging and adding refrigerant. The system shall operate efficiently with cooling water temperatures of between 40° and 50°F. The flow of water to the condenser shall be controlled by a regulating valve actuated by condenser gas pressures. The flow of refrigerant shall be regulated by a thermostatic expansion valve.

655-1.12.3.3 The base storage tank shall be two independent tanks with a capacity of not less than 30 gallons each. The tank shall be provided with a button/lint trap, solvent level sight glass and clean out access plate.

655-1.12.3.4 The still shall have a capacity of not less than 30 gallons and distill at a rate of not less than 50 gallons per hour. The still shall be provided with a drain and clean out cover to remove residue and oil buildup. A float assembly shall be installed in the still that will open the steam valve at a preset level to automatically initiate the distilling process. A manual valve shall be provided to secure the distilling process, if required, at any time while there is solvent in the still. A pressure relief valve shall be fitted on the still that will release at a pressure of 7 pounds per square inch. A sensing device shall be provided which automatically supplies water to the condenser any time the still is in operation.

655-1.12.3.5 The filtration canisters shall accommodate four paper/carbon core filter cartridges. The filter canisters shall recirculate solvent back to the cylinder, still or base storage tank.

655-1.12.3.6 A temperature gauge and regulator shall be provided which will activate the supplemental steam coil during the drying cycle. A temperature gauge shall also be provided which indicates the temperature of the air coming off the cooling coil to monitor the proper operation of the reclaim cycle.

655-1.12.3.7 The machine shall function without reduction in performance when operating at angles of 12 degrees to each side of a vertical plane.

655-1.12.3.8 The machine shall be provided with mounting bolt connections in order to secure the base of the machine to a hull foundation. The connections shall ensure adherence of the machine to the foundation under machinery and ship induced vibrational forces and ship motion.

655-1.12.3.9 An electric interlock shall prevent the shell door from opening while the machine is in operation and the machine shall not start with the door opened.

655-1.12.3.10 The machine shall be equipped with an adjustable vibration limit cut-out device to disconnect service should excessive, equipment damaging vibration occur.

655-1.12.3.11 Exposed belts, shafts, pulleys and other moving parts shall be fully enclosed by metal guards. Guards shall be firmly supported but readily removable for maintenance.

655-1.12.3.12 An emergency stop button or switch shall be located on the front of the machine within an accessible area. The button/switch shall bring the machine to an immediate stop when activated.

655-1.12.3.13 The machine shall provide reversing rotation of cylinder when in the wash speed. The cylinder shall reverse a minimum of three times per 95 seconds.

655-1.12.3.14 The machine shall operate on 440-volt, 60-hertz, 3-phase electrical system. The equipment shall conform to the recommended practices for electrical installation on board ship and shall be on an ungrounded electrical system. No grounds shall be permitted on the machine wiring.

655-1.12.3.15 Heating coils shall be constructed in accordance with ASME Boiler and Pressure Vessel Code, sections II and VIII. Flexible steam supply and condensate lines shall be composed of extruded or convoluted tetrafluoroethylene hose with stainless steel (CRES) braided reinforcement and threaded end couplings. Steam supply and condensate flexible hose assemblies shall be in accordance with the Society of Automotive Engineers (SAE) AS604 or AS620 specifications and Naval Ship's Technical Manual S6430-AE-TED-010.

655-1.12.3.16 A vapor containment system shall be provided that prevents the escape of solvent vapors from the cylinder when the shell door is opened. Air flow shall be drawn through slots surrounding the door into a carbon adsorption system which capture trace amounts of perc.

655-1.12.4 Dry cleaning machines shall be installed in accordance with the following requirements:

655-1.12.4.1 Service piping shall contain a flexible section of hose 14 to 18 inch in length installed between the ship's service piping and the dry cleaning machine (see **NSTM Chapter 505, Piping Systems**).

655-1.12.4.1.1 Steam supply and condensate lines shall be composed of extruded or convoluted tetrafluoroethylene hose with stainless steel (CRES) braided reinforcement and threaded end couplings. Steam supply and condensate flexible hose assemblies shall be in accordance with the Society of Automotive Engineers (SAE) AS604 or AS620 specifications and Naval Ship's Technical Manual S6430-AE-TED-010.

655-1.12.4.1.2 The cooling water flexible hose assemblies shall be constructed of synthetic rubber hose reinforced with wire or synthetic fiber and provided with threaded end couplings in accordance with MIL-H-24135/10 or MIL-H-24136/3.

655-1.12.4.1.3 The low pressure air supply line shall be plastic tubing capable of withstanding a working air pressure of 150 psi.

655-1.12.4.1.4 Flexible solvent lines to and from the sump are to be teflon hose with corrosion resistant reinforcement.

655-1.12.4.2 Dry cleaning machines with steam condensate lines shall use orifice assemblies. The strainer in the orifice assembly shall be installed upstream or in front of the orifice plate. The steam condensate lines should have a y-strainer installed upstream from the orifice and a stop check valve installed downstream from the orifice.

655-1.12.4.3 An electric solenoid valve shall be installed on the inlet side of the cooling water line and shall be interlock to the machine's main on/off switch. A cooling water regulator and gauge are to be installed and set at 45 psi or as specified by the equipment manufacturer. The pressure gauge should be designated and located such that it is clearly legible to the operator from the operator's normal position in front of the dry cleaning machine. The gauge must be periodically calibrated.

655-1.12.4.4 A steam gauge shall be installed on the main steam inlet line and a separate steam regulator and calibrated gauge shall be installed on the steam inlet line to the still. The pressure to the still must be regulated in accordance with the manufacturer's recommendation to prevent still boil over.

655-1.12.4.5 The dry cleaning space exhaust ventilation shall be interlocked with the dry cleaning machine to prevent operation of the machine without the ventilation system operating (COMNAVSEASYS COM LTR 56Y11/FHS/CW/SER 241, 12 JUL 83).

655-1.12.4.6 A ventilation exhaust downcomer shall be installed in the rear of the machine where high concentration of perchloroethylene vapors might accumulate; i.e. filter areas, still, button trap, etc. The exhaust downcomer shall be installed within the coaming area positioned approximately 9" above the deck.

655-1.12.4.7 The dry cleaning space ventilation ductwork shall be independent of ships exhaust system (NAV-SHIP 0938-018-0010) and vented overboard such that it will not contaminate other ventilation systems, accesses, compartments, etc.

655-1.12.4.8 The dry cleaning machine foundation shall be constructed of angle iron or similar structure properly reinforced so that it will not give under the stresses created by the machine. The foundation shall be reasonably level and flat to ensure metal to metal attachment to the washer-extractor base. The use of shims or grout to compensate for irregularities and to ensure complete bearing between mounting surfaces shall be in accordance with the manufacturer's instructions. Foundations made of long metal plates should be avoided. The use of metal plates tend to quickly disintegrate due to corrosion and vibrational forces.

655-1.12.4.9 The deckplate shall be reinforced to prevent vibration amplitudes from exceeding those amplitude levels specified in the latest revision of the General Ship Specifications, chapters 655 and 095-655.

655-1.12.4.10 Dry cleaning machines shall be surrounded by a 3" coaming with 1/2" diameter corrosion resistant rod on top of sufficient size to hold a spill equal to 110 percent of the working capacity of the machine. No deck drains shall be installed within the coaming.

655-1.12.4.11 Dry cleaning machines shall not be installed in the laundry space.

655-1.12.4.12 The solvent storage tank shall be installed with the following features:

655-1.12.4.12.1 A direct reading solvent level sight gage.

655-1.12.4.12.2 A clean-out plate.

655-1.12.4.12.3 A capped nipple drain.

655-1.12.4.12.4 A gravity feed fill line to the dry cleaning machine with a stop valve in the discharge line.

655-1.12.4.12.5 An air escape piped to 12 feet above the weather deck.

655-1.12.4.12.6 The tank material shall be corrosion resistant steel in accordance with Fed Spec QQ-S-766/class 304.

655-1.12.4.12.7 The fill line to tank shall be gravity fed from the weather deck or hangar bay.

655-1.12.4.13 Safety and operational placards for the machine ([Figure 655-1-5](#)) and storage tank shall be installed near the location where the event occurs or is caused to occur.

OPERATING INSTRUCTIONS AND SAFETY PRECAUTIONS

DRY CLEANING PLANT

WARNING

THIS MACHINE SHALL BE OPERATED BY QUALIFIED PERSONNEL ONLY. SERIOUS PERSONNEL AND EQUIPMENT HAZARDS EXIST DURING THE OPERATION OF THE MACHINE. DO NOT BYPASS OR DISCONNECT ANY SAFETY FEATURES. PERSONNEL MUST GUARD AGAINST EXCESSIVE EXPOSURE TO PERCHLOROETHYLENE VAPORS, CONTACT OF THE SOLVENT WITH THE SKIN, INGESTION AND SPLASHING OF SOLVENT INTO THE EYES. ENSURE ADEQUATE PERSONNEL PROTECTIVE EQUIPMENT IS AVAILABLE IN THE EVENT OF A SOLVENT LEAKS, SPILLS OR OTHER MISHAPS. THE MACHINE SHALL BE OPERATED IN AUTOMATIC MODE UNLESS SPECIAL CIRCUMSTANCES DICTATE OTHERWISE. DO NOT LEAVE THE SPACE UNATTENDED WHILE THE MACHINE IS IN OPERATION.

OPERATING INSTRUCTIONS

1. VERIFY POWER AND VENTILATION IS TURNED ON AND STEAM, WATER AND AIR VALVES ARE OPENED AS APPLICABLE. DRY CLEANING PLANT WILL NOT OPERATE WITH THE EXHAUST VENTILATION SECURED. DO NOT OPERATE MACHINE WITHOUT ADEQUATE STEAM OR COOLING WATER.
2. LOAD MACHINE WITH CLOTHING, DO NOT EXCEED MAXIMUM CAPACITY OF MACHINE. CLOSE AND SECURE LOADING DOOR.
3. START MACHINE. PLACE TIMER DIAL IN START POSITION AND PUSH START BUTTON. ON CLOSED CIRCUIT MACHINES WITH CARD CONTROLLER DEPRESS RESET BUTTON AFTER MACHINE HAS BEEN ENERGIZED, DEPRESS THE AUTOMATIC MODE PUSH BUTTON, INSERT THE PROGRAM CARD IN THE CARD TRANSMITTER SLOT, PLACE THE PROGRAM PAUSE BUTTON IN THE READY POSITION AND DEPRESS THE GREEN START BUTTON TO ACTIVATE THE FORMULA.
4. ALLOW THE MACHINE TO OPERATE THROUGH THE FULL AUTOMATIC OPERATION. PERIODICALLY MONITOR THE MACHINE OPERATION AND INFORM THE LAUNDRY SUPERVISOR OF ANY ABNORMAL OPERATION OR PRESENCE OF SOLVENT VAPORS.
5. AT CYCLE END CANCEL SIGNAL. ON CLOSED CIRCUIT MACHINES CANCEL SIGNAL BY DEPRESSING THE "AUTO" BUTTON, DO NOT TURN THE MACHINE OFF PRIOR TO UNLOADING CLOTHES OR THE DOOR EXHAUST FAN AND WATER SEPARATOR DRAIN WILL NOT ENERGIZE. OPEN CYLINDER DOOR AND REMOVE GARMENTS.
6. NOTIFY DRY CLEANING SUPERVISOR IF RESIDUAL SOLVENT SMELL REMAINS IN GARMENT WHEN REMOVED FROM PLANT. RESIDUAL SMELL IS AN INDICATION THE PLANT IS NOT DRYING, RECLAIMING OR DEODORIZING PROPERLY. THE PLANT SHOULD NOT BE RUN IF THE SOLVENT SMELL REMAINS EVIDENT IN THE FINISHED GARMENTS.

Figure 655-1-5 Operational and Safety Placard, Dry Cleaning Plant

655-1.12.4.14 Personal protective gear shall be available for perchloroethylene spills. The gear should consist of an organic respirator, goggles/face shield, coveralls, chemical gloves, chemical apron, and an eye wash station.

655-1.12.5 In order to ensure safe and proper dry cleaning operations the following installation and operational check-out steps are recommended:

655-1.12.5.1 Ensure control switches and indicators are properly functioning when in automatic cycle operations.

655-1.12.5.2 Ensure that the dry cleaning machine can not be started with the loading door open.

655-1.12.5.3 Ensure gaskets are in good condition (main door, button trap, lint trap, etc).

655-1.12.5.4 Ensure door latches will close, seat properly and are in good condition (main door, lint traps, button trap, etc).

655-1.12.5.5 Ensure that there are no leaks from the supply and return connections. Check the tightness of hose clamps, pipe joints, electrical panels screws, etc. Check freedom of movement of the indicator pins on all air operated valves.

655-1.12.5.6 Ensure steam piping is properly lagged.

655-1.12.5.7 Ensure drive belts are in good condition, aligned and tight.

655-1.12.5.8 Ensure belt guards are in place.

655-1.12.5.9 With the machine energized, the on/off switch in the on position and the loading door in the open position, verify operation of the dry cleaning machine exhaust fan.

655-1.12.5.10 Ensure that the cylinder drum is in good material condition.

655-1.12.5.11 Ensure that the exterior of the dry cleaning machine is in good sound condition.

655-1.12.5.12 Ensure that the bearings, the pump, drum, and motors are in good condition.

655-1.12.5.13 Ensure that the steam solenoid to the supplemental heating coil is thermostatically controlled and set at a maximum of 120 degrees F.

655-1.12.5.14 Check lubrication of motor/pump bearing, cylinder bearings, and air lubricator (if provided).

655-1.12.5.15 Ensure that the air pressure, steam pressure and water pressure regulators are set in accordance with the manufacturer's specifications.

655-1.12.6 Prior to operating the machine fill base storage tank with solvent and fill the filter housing in accordance with the manufacturer's instructions.

655-1.12.6.1 Ensure the solvent pump is properly primed prior to operation. The pump should never be run dry for more than one minute.

655-1.12.7 Different makes, commercial brands, and types of dry cleaning machines have slight variations in their principle operations. General dry cleaning machine operating steps are provided herein. For precise operating steps, the operator should review the Navy approved technical manual.

655-1.12.7.1 Rotate main control switch to the ON position to energize the machine.

655-1.12.7.2 Reset red lighted push button after machine has been energized.

655-1.12.7.3 Load machine with garments, close and secure loading door.

655-1.12.7.4 Place the machine in automatic mode depressing the "AUTO" button.

655-1.12.7.5 Insert program card in card transmitter slot. Align the line on the program card with the bottom of the card transmitter cover.

655-1.12.7.6 Place the program pause switch located on the card transmitter in the ready position.

655-1.12.7.7 Depress the green program start button on the card transmitter to active the programmed formula.

655-1.12.7.8 At cycle end cancel the signal by depressing the "AUTO" button. Do not turn the machine off prior to removing the load. The machine must remain on in order for the door fan and water separator valve to energize. Open cylinder door and remove garments. Ensure the exhaust fan is energized while the door is opened.

655-1.13 DRY CLEANING PRESSES

655-1.13.1 A dry cleaning press is composed of two heated pressing surfaces. The top pressing surface, the head, is the moving surface. The pressing surface of the head is a metal grid plate concave in shape and perforated with small holes. The head is comprised of a pressure chamber for heating and a spray chamber for relaxing garment fibers. The head pressing surface is covered with a perforated grid plate. The lower convex pressing surface (the buck) is stationary and is covered with padding and a cover cloth. The buck press plate is also perforated with holes like the head and also contains a pressure and spray chamber. The movement of the head to the buck pressing surface is accomplished using pneumatics and mechanical linkages. The shape of the head and buck allows the operator to press a garment efficiently and achieve a desired finish. Dry cleanable garments are finished using low temperature heat, pressure, and steam injection. During the pressing operation, steam is injected through the garment from the head and buck spray chambers using the head operating handle and foot pedal respectively. The injection of steam into the garment relaxes the fabric fibers so that the fibers flow into position under low temperature heat and pressure from the press. To set the finish, a vacuum pump attached to the buck spray chamber is used to draw-off the steam condensate and to dry the garment. The vacuum is activated using a foot pedal which opens a vacuum valve to the buck spray chamber. The padding on the press must be kept in

good condition (resilient) to achieve good finishing results and to prevent damage to items like buttons and zippers on garments. A dry cleaning press is designed to finish wool and polyester synthetic garments. A dry cleaning press can also finish cotton and cotton blends but to do so it requires more time than to finish the garments on a laundry press. The laundry press is sometimes referred to as a "hot head press" because it has a hotter head and buck than a dry cleaning press and can dry and finish press laundry garments quicker.

655-1.13.2 Dry cleaning presses shall be manufactured in accordance with the following configurations:

Type I - Presses, wool, utility

Class B - Press, wool, utility, pneumatically operated

Type III - Board, spotting, steam unit

Type V - Presses, wool, topper, pneumatic, automatic

Class A - Presses, wool, topper, pneumatic, automatic, 1-lay, without pleats

655-1.13.3 The applicable essential characteristics for dry cleaning presses are described in the following paragraphs.

655-1.13.3.1 Dry cleaning presses shall be sectionalized to allow the disassembly of the laundry presses into several subassemblies. A sectionalized dry cleaning press allows the press subassemblies to be transported through a standard shipboard 26 inch x 66 inch watertight door for reassembly and installation within the dry cleaning or laundry space without the need to cut a hull access.

655-1.13.3.2 Dry cleaning press frame shall be of malleable iron or steel finished for corrosion resistance. Gray cast iron or other brittle material shall not be used for structural parts or strength members.

655-1.13.3.3 Flexible steam hose assemblies shall be extruded or convoluted tetrafluoroethylene hose with stainless steel wire braid and end fittings in accordance with SAE AS604 or AS620. Exposed steam hoses shall be sheathed to prevent the operator or maintenance personnel from incidental contact that might result in burn accidents.

655-1.13.3.4 Exposed pulleys, gears, springs, cams, rollers and other moving parts shall be fully enclosed and guarded to prevent contact with personnel. Provisions shall be made to readily remove guards over parts requiring adjustment and maintenance.

655-1.13.3.5 The base of the machine shall be fitted with not less than four bolt holes for anchoring the machine to a hull foundation.

655-1.13.3.6 The dry cleaning press head and buck assemblies shall be steam heated and conform to the ASME Boiler and Pressure Vessel Code, section VIII.

655-1.13.3.7 Means shall be provided for automatically adjusting the head and/or buck to conform to varying thicknesses of the garments being pressed and to accommodate buck padding shrinkage.

655-1.13.3.8 The press head shall return to the open position when the low pressure (LP) air is turned off.

655-1.13.3.9 In case of an obstruction between the head and the padded buck of 3/4 inch or greater, or if the safety control bar comes in contact with same obstruction, the moving member shall not lock closed, and upon release of one or more of the closing buttons, the head shall release to the open position. This prevents the laundry press from crushing the operators hands and arms if caught between the head and buck during the closing operation.

655-1.13.3.10 The dry cleaning press shall be pneumatically operated. Movement of the press head shall be controlled by two manual operated push buttons located not less than 10 inches apart, recessed, and arranged so that both controls must be operated simultaneously, requiring the use of both hands, during the entire closing and locking operation. Upon releasing one or both controls prior to the head reaching the closed position, the head shall return automatically and promptly to the open position.

655-1.13.3.11 A finished, metal work table shall be provided under the buck.

655-1.13.3.12 An air regulator and gauge shall be installed on the LP air supply line of each dry cleaning press and constant LP air pressure must be provided to the laundry press to maintain proper operation.

655-1.13.4 Dry cleaning presses shall be installed in accordance with the following requirements:

655-1.13.4.1 The foundation shall be reasonably level and flat to ensure metal to metal attachment of the press to the foundation.

655-1.13.4.2 Posting of safety and operational placards ([Figure 655-1-6](#)) are required at each press station.

WARNING

THIS EQUIPMENT SHALL BE OPERATED BY QUALIFIED PERSONNEL ONLY. SERIOUS PERSONNEL AND EQUIPMENT HAZARDS EXIST DURING THE OPERATION OF THE PRESS. DO NOT BYPASS OR DISCONNECT ANY SAFETY FEATURE SUCH AS THE DUAL CLOSING BUTTONS, SAFETY BAR AND HEAD LOCKING MECHANISM. DO NOT OVERRIDE TWO HAND OPERATION.

OPERATING INSTRUCTIONS

- 1. PRIOR TO OPERATING THE PRESS ENSURE PROPER STEAM PRESSURE OF 70–80 PSI TO OBTAIN A HEAD TEMPERATURE OF APPROXIMATELY 275°F. ADJUST AIR PRESSURE TO 80 PSI.**
- 2. INSPECT PADDING. PADDING SHOULD BE 3/4 TO 1 INCH DEEP, RESILIENT, CLEAN AND NOT EXCESSIVELY WORN. PADS SHOULD BE CHANGED BI-MONTHLY AND COVERS WASHED WEEKLY.**
- 3. LAY GARMENT ON BUCK.**
- 4. LOWER PRESS HEAD BY DEPRESSING BOTH CLOSING BUTTONS SIMULTANEOUSLY UNTIL THE HEAD IS CLOSED AND LOCKED. RELEASING ONE OR BOTH BUTTONS ON THE DOWN STROKE WILL RELEASE THE HEAD TO THE OPEN POSITION.**
- 5. INJECT STEAM INTO GARMENT BY DEPRESSING THE MANUAL HANDLE FOR HEAD STEAM AND/OR DEPRESSING THE MANUAL FOOT PEDAL FOR BUCK STEAM. REMOVE MOISTURE AND SET THE FINISH IN THE GARMENT BY DEPRESSING THE MANUAL FOOT PEDAL TO ACTIVATE THE VACUUM.**
- 6. DO NOT LEAVE PRESS UNATTENDED WHILE GARMENT IS IN THE PRESS AND THE HEAD IS IN THE CLOSED POSITION.**
- 7. AFTER THE GARMENT HAS BEEN PROPERLY PRESSED RELEASE THE HEAD BY EITHER DEPRESSING THE OPEN BUTTON OR LIFTING UP ON THE SAFETY RELEASE BAR.**
- 8. REPEAT ABOVE STEPS FOR THE REMAINING LAYS.**
- 9. AFTER GARMENT IS COMPLETELY PRESSED REMOVE AND HANG AS SOON AS POSSIBLE.**

Figure 655-1-6 Operational and Safety Placard, Dry Cleaning Press

655-1.13.4.3 Dry cleaning presses installed with steam condensate lines shall use orifice assemblies. The strainer in the orifice assembly shall be installed upstream or in front of the orifice plate. The steam condensate lines should have a y-strainer installed upstream from the orifice and a stop check valve installed downstream from the orifice.

655-1.13.4.4 A ventilation exhaust hood shall be installed on each utility press head to remove heat generated by the equipment at a rate of 500 cubic feet per minute.

655-1.13.5 In order to ensure safe and proper dry cleaning press operations the following installation and operational check-out steps are recommended:

655-1.13.5.1 Ensure that the inspection covers and panels are securely in place.

655-1.13.5.2 Ensure that the air regulator is adjusted at the proper LP air pressure for the dry cleaning press. The proper LP air pressure setting for the dry cleaning press can be located in the equipment technical manual.

655-1.13.5.3 Ensure that the head and buck heat up properly and maintains an even temperature across both pressing surfaces.

655-1.13.5.4 Ensure proper head temperature of approximately 285 degrees F which should be maintained with 75-80 PSIG steam. This is the average temperature and pressure to provide steam with the proper moisture content.

655-1.13.5.5 Ensure that the steam and LP air service piping is not leaking.

655-1.13.5.6 Ensure that the steam piping is properly lagged.

655-1.13.5.7 Ensure that the closing speed of the head is smooth. The dry cleaning press closing speed and smoothness of operation can be changed by adjusting the needle valve and shock absorber respectively.

655-1.13.5.8 Ensure that the shock absorber/snubber is filled with oil.

655-1.13.5.9 Ensure that there is 3/4 to 1 inch of resilient padding on the buck.

655-1.13.5.10 Ensure that a buck cover is installed over the padding with the correct side out. The buck cover must be clean, not worn, and held tightly in place by the draw string and springs.

655-1.13.5.11 Ensure that the head grid plate is clean, not worn, and held tightly in place by a draw string.

655-1.13.5.12 Ensure the flexible hose from the dry cleaning press head ventilation hood to the exhaust ductwork is connected and in good condition.

655-1.13.5.13 Ensure the vacuum pump is connected to the dry cleaning press and is activated using the vacuum foot pedal on the dry cleaning press.

655-1.13.5.14 Ensure that the steam injection through the head and buck is functioning by operating the head steam hand valve and the buck steam foot pedal valve respectively.

655-1.13.6 Different makes and types of dry cleaning presses have slight variations in their principle operations. General dry cleaning press operating steps are provided herein. For precise dry cleaning press operating steps, the operator should review the Navy approved technical manual and NAVEDTRA 10293.

655-1.13.6.1 Open the steam supply and condensate return line valves. Heating time for the dry cleaning press is 20 to 30 minutes.

655-1.13.6.2 Open the LP air supply line and check the air pressure gauge on the dry cleaning press. Adjust the dry cleaning press air regulator to the appropriate LP air pressure setting for the dry cleaning press.

655-1.13.6.3 Activate the dry cleaning press closure by simultaneously depressing both recessed buttons. Adjust the dry cleaning press head closing speed and smoothness by adjusting the air needle valve and shock absorber respectively.

655-1.13.6.4 Determine the number of press lays required to press the garment or garments.

655-1.13.6.5 Determine the logical sequence of press lays to efficiently press the garment or garments.

655-1.13.6.6 Lay the garment or garments on the buck pressing surface.

655-1.13.6.7 Inject steam through the buck for 2 to 3 seconds to relax the garment fibers while simultaneously depressing both closure buttons to close the dry cleaning press head to the buck pressing surface. It may be necessary to apply the vacuum during the closing operation to hold the garment in place.

655-1.13.6.8 Inject steam through the head after the dry cleaning press is closed for 1 to 3 seconds.

655-1.13.6.9 During the last 6 to 8 seconds of closure time of the dry cleaning press the vacuum should be applied to set the garment finish and to dry the garment and buck padding.

655-1.13.6.10 Closure time of the dry cleaning press is roughly 15 seconds, however the actual pressing time depends on the material and the dampness of the garment being pressed.

655-1.13.6.11 Open the dry cleaning press using the opening release button or bar.

655-1.13.6.12 Repeat steps 3 through 7 until the garment or garments are finished.

655-1.14 SPOTTING BOARDS

655-1.14.1 The spotting board is comprised of a main spotting board, sleeve board, garment tray, chemical tray, and spotting gun. The primary function of the spotting board is to remove stains from garments. The main sleeve spotting boards consist of smooth surfaces where chemicals are applied or tamped in and a perforated end plate where the chemicals are drawn off and flushed from the garment. A foot pedal activates a vacuum system at the perforated end plate which draws the chemical solutions from the garment while holding the stained section of the garment in place. The chemicals are flushed from the garment using the spotting gun which can supply dry or wet steam. Control of the dry or wet steam for the spotting gun is provided by activation of a foot pedal. Slight pressure on the steam foot pedal delivers dry steam and full activation of the foot pedal provides wet steam. The spotting gun is also used to dry the garment after spotting has been performed. Depressing the air foot pedal delivers warm dry air from the spotting gun to dry the garment. The garment tray on the spotting board is located underneath the main spotting board and holds the garment being spotted. The chemical tray is provided to hold all the needed spotting chemicals.

655-1.14.2 The applicable essential characteristics for spotting boards are described in the following paragraphs.

655-1.14.2.1 Delivery of wet steam, dry steam and warm compressed air from the spotting gun with proper use of the foot pedals provided.

655-1.14.2.2 Vacuum to draw off cleaning fluids after spotting is supplied at the end plate of the main or sleeve spotting board and is activated by using a foot pedal.

655-1.14.2.3 Sleeve board swings above the main spotting board and locks in for operation to perform spotting operations on smaller garment configuration.

655-1.14.3 Installation descriptions and requirements are provided in the following paragraphs:

655-1.14.3.1 Securely mount spotting board to a hull foundation such that it will not come adrift due to ship's motion or in battle condition.

655-1.14.3.2 Utilities may be hard piped vice using flexible connections due to the small draw of utilities for the spotting board which alleviates water hammer.

655-1.14.3.3 Spotting boards requiring drainage may be hard piped into a deck drain.

655-1.14.3.4 A flexible vacuum pump connection is required from vacuum pump to the vacuum valve on the spotting board.

655-1.14.3.5 Steam utility hook-up is similar to the laundry and dry cleaning presses utility connection.

655-1.14.3.6 An orifice is installed on steam condensate lines.

655-1.14.4 Operational checks are described as follows:

655-1.14.4.1 The spotting gun is capable of delivering wet steam, dry steam, and hot compressed air.

655-1.14.4.2 Vacuum to the main spotting plate end is activated by foot pedal with the sleeve board secured.

655-1.14.4.3 Swinging the sleeve board into it's operational position will switch the vacuum from the main board end plate to the sleeve board end plate.

655-1.14.4.4 Operation of the vacuum foot pedal will provide a vacuum to the sleeve board when the sleeve board is swung into it's operational position.

655-1.14.4.5 Ensure that steam piping is lagged.

655-1.14.4.6 Ensure that the LP air supply is set at 80 psi or as specified in the equipment technical manual.

655-1.14.4.7 Ensure that there are no leaks in the service connections.

655-1.15 FORM FINISHERS

655-1.15.1 A form finisher consists of an expandable air bag and holding stanchion or clamp to finish garments which are difficult or time consuming to perform on a conventional dry cleaning press. The garment is fitted over the air bag which expands to fit the garment. Steam is injected through the garment to relax the garment fibers and then warm dry air is injected through the garment to dry and set the finish. The Navy uses two types of form finishers; a pants topper, and a body finisher for jackets and coats.

655-1.15.2 Dry cleaning pants topper presses shall be manufactured in accordance with the following configurations:

Type V - Presses, wool, topper, automatic

Class A - Presses, wool, pants topper, pneumatic, automatic, 1-lay, without pleats clamps

655-1.15.3 The applicable essential characteristics for pants topper presses are described in the following paragraphs.

655-1.15.3.1 Manual steam and air foot switches shall be provided.

655-1.15.3.2 Adjustable automatic steam and air cycles shall be provided with a range of 0 to 30 seconds.

655-1.15.3.3 An adjustable air bag to fit garments being finished shall be provided.

655-1.15.3.4 The buck assemblies shall be steam heated and conform to the ASME Boiler and Pressure Vessel Code, section VIII.

655-1.15.3.5 Electrical power shall be 115 volt-60 cycle-single phase.

655-1.15.3.6 A water misting gun shall be provided to relax garment fibers for the finishing process.

655-1.15.3.7 A manually operated foot pedal shall be provided to start the automatic finishing cycle.

655-1.15.4 The applicable essential characteristics for body form finishers are described in the following paragraphs.

655-1.15.4.1 A manual or air operated shoulder expander to hold and shape garment for finishing shall be provided.

655-1.15.4.2 Electrical power shall be 115 volt-60 cycle-single phase.

655-1.15.4.3 Front and rear clamps shall be provided to hold the garments in place for finishing.

655-1.15.4.4 Adjustable automatic steam and air cycles shall be provided with a range of 0 to 30 seconds.

655-1.15.4.5 Sleeve forms shall be provided to open sleeves on coats and jackets to finish properly.

655-1.15.4.6 Air working pressure shall be 70 psig minimum.

655-1.15.4.7 Steam working pressure shall be 65 psig minimum.

655-1.15.4.8 Foot pedals shall be provided to manually operate the steam and air cycles for any length of time required for finishing.

655-1.15.4.9 A manually activated foot pedal shall be provided to start the automatic finishing cycle.

655-1.15.4.10 An adjustable air bag to fit garments being finished shall be provided.

655-1.15.4.11 The buck assemblies shall be steam heated and conform to the ASME Boiler and Pressure Vessel Code, section VIII.

655-1.15.4.12 A water misting gun shall be provided to relax garment fibers for the finishing process.

655-1.15.4.13 The form finisher shall provide 360 rotation of the stanchion to adjust garment while on the stanchion, with clamp in place, and insert sleeve expanders for finishing.

655-1.15.5 Installation descriptions and requirements are provided in the following paragraphs:

655-1.15.5.1 Mount the form finisher to a hull foundation such that it will not come adrift in rough seas or battle conditions.

655-1.15.5.2 Utilities may be hard piped vice using flexible connections due to the small draw of utilities for the form finisher which alleviates water hammer.

655-1.15.5.3 An orifice shall be installed on steam condensate return lines.

655-1.15.6 Operational checks are described as follows:

655-1.15.6.1 Ensure LP air is set at 80 psi.

655-1.15.6.2 Ensure that the steam piping is properly lagged.

655-1.15.6.3 Ensure that there are no leaks at service connections.

655-1.15.6.4 Ensure that the form finisher operates in both the manual and automatic modes.

655-1.16 SEWING MACHINES

655-1.16.1 Sewing machines operate by interlocking threads from two sources on the machine - the upper thread, which is pushed into the material by the sewing needle, and the bobbin thread, which is caught from under the material by the needle. A correctly locked stitch results when the upper and lower tensions are balanced so that the needle and bobbin threads are drawn equally into the material. In order to operate the sewing machine it is necessary to correctly insert the needle, thread the machine properly, and to wind and insert the bobbin properly. To insert the needle, raise the needle bar to its highest point by turning the hand wheel, loosen the needle clamp screw and insert the needle with the flat side of the needle toward the rear of the machine, then tighten the needle clamp screw. The upper thread is taken up from on the thread stand and brought through the thread guides, around the tension dial, through the take-up lever, through the thread guides, and then inserted through the needle. The needle bar should be at its highest point when threading the needle. After threading the needle, a sufficient amount of thread should be drawn to prevent it from slipping out when operating the machine. The second thread source is the bobbin. To wind the bobbin, place empty bobbin on spindle. It is necessary to turn the stop motion screw counter clockwise to disconnect the sewing mechanism. Take the thread from the spool and guide it through the thread guide and then around the bobbin. Move the bobbin winder spindle to the left and then press the foot or knee pedal to begin winding. When bobbin is full, move spindle to its original position, reattach the sewing mechanism by turning the stop motion screw clockwise and remove bobbin. The bobbin is inserted into the bobbin case, with the thread being drawn under the spring and then through the delivery eye of the bobbin case. The bobbin case is inserted into the machine by holding onto the latch and placing it into the spindle stud until it catches and then releasing it. After inserting the bobbin in the machine the bobbin thread must be drawn up by holding the upper thread lightly with the left hand and while turning the hand wheel slowly with the right until the needle enters the needle hole to catch the bobbin thread and draw it up. Both threads should be drawn under the presser foot to the back of the machine in preparation for sewing. Material is sewn by placing it under the presser foot, lowering the presser foot by means of the presser bar lifter and then applying pressure to the knee or foot pedal. It is not necessary to pull or push the material, just guide it in the desired direction. Material is moved by the feed mechanism which is located under the throat plate. Stitch sizes are determined by adjusting the stitch regulator.

655-1.16.2 In accordance with Section 655 of the General Specifications for Ships of the U.S. Navy, a sewing machine, conforming to Fed Spec. 00-S-256, type I, style A, class 3, shall be provided in a remote area of the dry cleaning finishing area on ships having more than 1500 total accommodations. A commercial tailoring type blind stitch machine shall be provided adjacent to the sewing machine, conforming to Fed. Spec. 00-S-256, in accordance with General Specification Section 655.

655-1.16.2.1 A modular drawer stowage cabinet, similar or equal to Stanley Vidmar DW-175, shall be installed adjacent to the sewing machines for the stowage of sewing supplies and serving as a sewing station work table.

655-1.16.3 Some of the unique and required design features covered in Fed. Spec. 00-S-256 are described in the following paragraphs.

655-1.16.3.1 Depending upon the type of machine purchased and procured, the machine shall be either lock stitch or blind stitch type, and be capable of sewing medium to heavy duty material.

655-1.16.3.2 The type I sewing machine shall be equipped with a reversible type "A" feed mechanism; and the blind stitch sewing machine shall be equipped with a type "A" feed mechanism.

655-1.16.3.3 The machine shall operate at speeds not less 2000 or greater than 2200 stitches per minute.

655-1.16.3.4 The machine shall be equipped with a bobbin winder, knee operated presser foot lifter, and thread stand.

655-1.16.3.5 The machine shall be equipped with a horizontal axis oscillating shuttle, central bobbin, and link take-up lever.

655-1.16.3.6 The machine shall be mounted to a table constructed of particle board or multi-plywood core material, and covered with a decorative, thermosetting, plastic laminate sheets.

655-1.16.3.7 The table shall be affixed to a stand, fabricated from minimum 13-gauge steel material, with adjustable legs, braces, and the ability to have foot treadles.

655-1.16.3.8 The machine shall be equipped with an electrical light fixture, constructed with a flexible goose neck type chrome arm, and a cone shaped reflector for the bulb.

655-1.16.4 Installation and operational requirements are as follows:

655-1.16.4.1 Securely mount table stand to a hull foundation which has been welded to the deck.

655-1.16.4.2 The machine should be connected to shipboard electrical system, and is designed to operate on 120 volt-60 cycle-single phase electrical power.

655-1.16.4.3 Electrical light fixture should be mounted securely to the table top.

655-1.16.4.4 Mount sewing machine head to table top with applicable hardware, if head has not already been installed by manufacturer.

655-1.16.4.5 Securely install any tool and accessory drawers in their respective sliding tracks.

655-1.16.4.6 Ensure that the bobbin winder is functional to the extent that when a empty bobbin is inserted into bobbin winder, and powered, it will achieve full threading capacity.

655-1.16.4.7 Ensure that stitch formation complies with stitch types specified for the machine.

655-1.16.4.8 Ensure that the stitch range regulator is in compliance with machine features.

655-1.16.4.9 Ensure that the machine wiring has not been cut or abraded, and has sufficient slack to provide strain relief.

655-1.16.4.10 Ensure that the knee lifter is maneuvering presser foot properly.

655-1.16.4.11 Ensure that the drive belt is in good condition, aligned and tight.

655-1.16.4.12 Ensure that the foot treadles are functioning and have been adjusted into position to meet the needs of the operator.

655-1.16.4.13 Ensure that all tools and accessories for the sewing machine are located in table drawers.

655-1.16.4.14 Ensure that the automatic thread tension release is effective when the presser foot is raised.

655-1.17 VACUUM SYSTEM

655-1.17.1 A vacuum system is comprised of a tank and pump. The vacuum is created by an impeller expelling air from the tank to the atmosphere creating a negative pressure differential between the tank and atmosphere. The vacuum tank is connected to dry cleaning presses and spotting boards which require vacuum supply to perform their intended functions.

655-1.17.2 The vacuum pump is manufactured in accordance with 00-D-735, revision C, under item 1 (air vacuum unit), class 2 (vertical type).

655-1.17.3 Installation and operational requirements are as follows:

655-1.17.3.1 Mount the vacuum pump securely to a hull foundation such that it will not come adrift due to ship's motions or battle conditions.

655-1.17.3.2 The suction line shall contain a section of flexible hose on the vacuum tank inlet and the dry cleaning press or spotting board outlet. The line shall be pitched toward the vacuum unit to prevent moisture from gravitating back toward the press or spotting board.

655-1.17.3.3 An flexible exhaust line shall be installed to the ventilation exhaust duct.

655-1.17.3.4 The drain line from the vacuum tank to a deck drain shall be hard piped with a check valve installed to drain into the deck drain.

655-1.17.3.5 Ensure that the vacuum applied to the dry cleaning press adequately draws off steam condensate from the garment and buck pressing surface or that the vacuum applied to the spotting board holds the garment's area to be cleaned in place and withdraws the spotting chemicals and water from the garment.

655-1.17.3.6 Ensure that there are no leaks in the service piping.

SECTION 2.

FABRICS AND FABRIC CARE

655-2.1 FABRIC TYPES

655-2.1.1 The process the uniform or linen receives in the laundry depends upon the type of the fiber from which it is woven. It is important that shipboard laundry operators are familiar with the various types of fibers most often encountered. The fibers of which uniforms and linens are made are classified into two general categories; natural and synthetic.

655-2.1.1.1 Natural fibers comprise three general groups or classifications: vegetable, animal, and mineral. The principal vegetable fibers are cotton, flax (linen), etc. Those of the animal grouping are wool, silk, leather, etc. Common mineral fibers are made from glass and asbestos and are seldom encountered in the shipboard laundry. Asbestos material shall not be laundered.

655-2.1.1.2 Synthetic materials are man-made of various types of: cellulosic fibers (rayon), vinyl fibers, polyamides (nylon), and polyester. Polyester fibers are made with elements derived from coal, air, water, and petroleum. Not all polyester is the same; there are many types, which vary in their original chemical properties. Trade names such as Dacron, Fortrel, and Kodel are types of polyester fabrics. Polyester fiber is nearly twice as strong as cotton. When resin, heat or crease treated, the polyester fabric contains a memory or tendency to return to its original shape.

655-2.1.1.3 Garments also includes many combinations of natural and/or synthetic fibers called blends. These are variously described, for example, as 65/35 or 50/50, depending on the percentage of the fibers in the blend. Where the fiber is half cotton and half polyester, it is called a 50/50 blend.

655-2.2 FABRIC CARE

655-2.2.1 The processes established for shipboard laundering is limited to the few fabrics and blends encountered on a ship. In most instances, of the vast majority of fabrics and blends available commercially, the Navy is concerned with the proper care of only a very few. These generally consist of 100 percent cotton or denim, cotton and polyester blends, 100 percent polyester (CNTs) and wool dress uniforms.

655-2.2.2 The Federal Care Labeling Act, which became effective 3 July 1972, requires that manufacturers specify laundry or dry cleaning instructions, or both, on the label of each garment. The Navy Clothing and Textile Research Facility has determined the proper care of all authorized uniforms. All authorized garments are labeled with the appropriate care label which typically identifies standard Navy wash formulas I, II or III or dry clean only. This information is helpful to prevent damage to clothes during processing. It is important that shipboard laundry operators examine and adhere to the care labels on garments before laundering, when undecided as to the material type or handling procedures.

655-2.2.3 It is impractical to prescribe hard-and-fast rules regarding damage suffered by fabrics in the laundry. Good practice requires that all processing times and temperatures, as well as concentrations of chemical supplies, be reduced to a point at which effective cleaning will be obtained with minimum harmful effect on the fabric. Excessive bath temperatures, extended wash, rinse and extract times, and excessive drying and pressing time and temperature should be avoided because they induce fabric damage and reduce garment life.

655-2.2.3.1 The standard Navy wash formulas were developed and tested specifically for shipboard laundry processing. These formulas provide the highest quality wash with the shortest possible washing cycles and minimum potable water consumption. These formulas must be strictly adhered to and the washer-extractor shall be operated in automatic mode only. Automatic operation will efficiently process the shipboard laundry and also minimize the excessive wear and tear on the machine which is typically the result of improper manual operation.

655-2.2.4 In order to successfully process linen or garments which contain polyester fibers, there are general guidelines which should be followed.

655-2.2.4.1 Do not wash whites and colors together, since white polyester blend fabrics may have an affinity for loose dye in the wash cycle. When loose or fugitive dye is picked up by white polyester fibers, it is often difficult to remove.

655-2.2.4.2 When polyester uniforms (CNTs) require pressing they shall be finished on a dry cleaning press whenever possible. Hot head laundry presses will easily damage CNTs if improperly presses at high temperatures. If CNTs are pressed on a hot head press, the head and buck temperatures must be reduced. Also, a throw away cloth for misting the garment or a head grid plate must be used to prevent the polyester fibers from melting which will cause a permanent shine on the garment. Additional care must be taken when using a hot head press since stains may be set in instead of cleaned out by the steam action of a dry cleaning press.

655-2.2.5 Wool fibers are very susceptible to mechanical injury when wet and excessive shrinkage when dried at high temperatures. Therefore all wool garments, with the exception of blankets, shall be dry cleaned unless instructed otherwise by the care label. In order to provide the highest quality of dry cleaning the solvent must be maintained at the cleanest level possible through continuous filtering and distillation. The paper and carbon core filters will remove suspended particles, dyes and odors from the solvent. The still will remove oils, grease and other organic material. Proper operation of the water separator is also important in order to prevent garment spotting and shrinkage caused by residual water in the solvent.

655-2.3 SPECIAL INSTRUCTIONS IMPREGNATED CLOTHING

655-2.3.1 Chemical and biological warfare protective (impregnated) clothing requires special laundering precautions because high water temperature, strong soaps, and alkalies will destroy the impregnate.

655-2.3.2 To launder impregnated clothing, prepare a soap solution by dissolving a neutral laundry soap or, preferably, a mild salt water soap, in soft water at 90°F. If possible, water from the ship's evaporators should be used and a good suds built up before adding the clothing. The clothes should be washed in three five-minute sudsings at the customary suds level, with the solution changed for each sudsing.

655-2.3.3 Impregnated clothing should be extracted for a period of about ten minutes.

655-2.3.4 Drying of impregnated clothing must be done carefully since excessive heat will cause loss of impregnate and many also destroy the clothing. Care must be exercised to prevent spontaneous combustion of clothing when removing from tumbler. Without any load in the cylinder, operate the tumbler for 15 minutes, admitting steam to only one bank of heater coils, and insure that the temperature does not exceed 175° F. Adjust dampers if necessary. When this condition is met, the tumbler is ready to dry protective clothing.

655-2.3.5 It is important that the temperatures of protective clothing be kept between 160° and 170°F during processing or laundering. The clothing shall be removed from the tumbler at once after drying is completed and immediately separated and folded. Drying also may be accomplished by hanging the clothing on a line, but impregnated clothing should not be exposed to direct sunlight.

655-2.3.6 Impregnated garments must never be ironed or dry cleaned. Normally they can be laundered three times before their protective qualities become inadequate, but representative samples of the clothing shall be tested after each laundering to determine whether they should be reimpregnated.

SECTION 3. STAIN REMOVAL

655-3.1 METHODS

655-3.1.1 A large majority of stains are removed in the normal laundering process. Many stains, however, require special treatment. Furthermore, it should be remembered that some stains cannot be removed without the destruction of the fibers themselves. Blood, and food stains (such as gelatin, albumin, egg, and mayonnaise) are coagulated or set by heat, and these stains ordinarily are removed in the break operation of the standard washing process at temperatures not exceeding 100°F. They are much more easily removed if they are treated when fresh. Bloodstained and grossly soiled items should be individually hand washed before being sent to the laundry.

655-3.1.2 When treating stains, it is advisable to start with the simplest operation, because certain reagents tend to set stains, rendering them difficult or impossible to remove. A particular sequence of treatment described in the following paragraphs, should be utilized in treating stains which remain after washing.

CAUTION

Use of the applicable personnel protective equipment, such as gloves, goggles, etc., and compliance with the precautions identified on the Material Safety Data Sheet of the particular stain removing chemical shall be strictly adhered to. Stain removal should take place under the best possible light conditions and with adequate ventilation. Special care should be exercised when using flammable solvents to insure the absence of flames or spark producing tools. For example, tetrachloroethylene is nonflammable, but must not be used under conditions of poor ventilation because its vapors are toxic.

655-3.1.3 Locally wash the stain with a concentrated soap solution. Fugitive colors and wool fabrics should be treated with a detergent. Rinse well. If stain is not removed, continue treatment in accordance with the following spotting procedure.

655-3.1.4 Any stain which resist the normal washing process or locally concentrated removal efforts must be removed by spotting. Spotting is a specialized art and requires skill in identifying the nature of the stain and in using the proper agent to remove it without damaging or otherwise affecting the cloth, or leaving a ring around the spot from which the stain was removed.

655-3.1.4.1 The spotter must be familiar with textile fibers, sizing materials, dyes used, stains or spots likely to be encountered, and proper agents or chemicals to be used and their probable action on the various fibers and dyes.

655-3.1.4.2 The precautions given in paragraphs [655-3.1.4.2.1](#) through [655-3.1.4.2.10](#) are to be understood before a stain removal operation is undertaken.

655-3.1.4.2.1 Methods recommended for white goods are equally effective for colored goods, providing the reagents used have no effect on the color of the material.

655-3.1.4.2.2 Tests always should be made on some hidden portion of the garment, such as any extra seam allowance that may be present, before the spotting agent is applied to the cloth.

655-3.1.4.2.3 Chlorine-bleach or concentrated and warm solutions of alkalies should never be applied to any material containing silk, wool, mohair, or other animal fiber.

655-3.1.4.2.4 Traces of mineral acids (such as sulfuric and hydrochloric) or acid salts that hydrolyze to form either of these, should not be permitted to dry or be pressed into cotton, linen, or rayon fabrics.

655-3.1.4.2.5 Rayon articles and other synthetic fabrics should never be treated with organic solvents unless resistance to treatment is known by preliminary test on an unexposed portion of the garment.

655-3.1.4.2.6 Color strippers are used to remove dye from fabrics; high-potency liquid titanium stripper is recommended. It will safely remove fugitive dye stains from white and colored articles in laundry and dry cleaning.

655-3.1.4.2.7 All agents used for stain removal must be rinsed from the article thoroughly prior to drying or pressing to prevent attack on the material.

655-3.1.4.2.8 Excessive frictional action should be avoided. This is especially important when treating silk and rayon fabrics. Where some friction becomes necessary, chafing often can be avoided by working on the reverse side of the garment.

655-3.1.4.2.9 Large ships shall make full use of the spotting board, if installed, for stain removal. On smaller ships without a spotting board, removal of small stains may be accomplished with minimum friction by one of the following procedures:

1. Stretch the stained area over a bowl of cold water and apply the appropriate spotting agent with a medicine dropper. Gently work the agent into the stain with a nylon bristle spotting brush. Rinse garment thoroughly.
2. Place the stained fabric over a pad of clean folded cloth, or white blotters, and apply the appropriate spotting agent with a medicine dropper or with a clean pad or cloth saturated with the spotting agent. Gently work the agent into the stain with a nylon bristle spotting brush. Rinse garment thoroughly.

655-3.1.4.2.10 When removing stains, it is necessary to perform the operation in as short a time as possible in order to minimize the extent to which the fabric is exposed to chemical action.

SECTION 4.

LAUNDERING AGENTS AND SUPPLIES

655-4.1 LAUNDERING AGENTS

655-4.1.1 Detergents sometimes are referred to as synthetic detergents or synthetic soaps. The term synthetic, in its broadest sense, refers to the synthesis (building up) of materials to form a product different from natural substances. A detergent, as the term generally is used, is entirely different from a soap.

655-4.1.2 The detergent to be used in washing all shipboard cotton, synthetic and blended fabrics, and wool blankets, is that stocked in the Federal Supply System and procured in accordance with Navy Clothing and Textile Research Facility Purchase Description NCTRF/PD11-85A of 23 July 1986.

655-4.1.2.1 Nicknamed "Two-Shot", the detergent contains an oxygen bleach which will not harm colored clothing, is low in phosphate (which may degrade the fire retardancy treatment at higher concentrations) and is low sudsing. "Two-Shot" detergent shall be used for Navy Wash Formulas I, II, and III.

655-4.1.2.2 "Two-Shot" is equally efficient in hard seawater and soft water and is effective in hot or cold water.

655-4.1.3 In addition to the detergent-bleach being required for use on all Navy Wash formulas, a laundry sour (blue) is also required.

655.4.1.3.1 A laundry sour (blue) is an acid that is safe to use on fabrics. It should be added to the last rinse to neutralize remaining alkalies (reduce Ph level) and to dissolve iron and other metallic salts which cause rust or a yellow discoloration. If left in fabrics, an alkali causes odors and discoloration after drying. Also, if the sour blue is omitted from the laundering process, itching and discomfort is likely to occur, particularly when working in areas with a high ambient temperature, due to the high Ph level of the clothing.

655.4.1.3.2 Use of a sour in the last rinse also removes sodium bicarbonate, which normally is in rinse water; even when all the alkalinity is rinsed out, sodium bicarbonate remains. It is not injurious to fabrics, but when subjected to the heat of flatirons, presses, and flatwork ironers, it is converted to sodium carbonate, which is quite alkaline and can cause injury to fabrics when in sufficient concentration and contribute to itching and discomfort.

655.4.1.3.3 Souring also decomposes any oxidizing bleach left in a load, prevents discoloration, and helps to sterilize the clothes. In addition, sour sets acid dyes often used in bright colored fabrics, and preserves the tensile strength of fibers. Sours also remove rust stains.

655-4.1.4 Sizing or starch (instant, dry) usually is prescribed for cotton shirts, trousers, and coats and uniforms, but is never used with synthetic or synthetic-blend fabrics or with work clothes.

655-4.1.4.1 The amount of sizing should be just sufficient to give the garment a pleasing body and feel without undue stiffness. The sizing operation is normally conducted with the sour operation during the final rinse step. On machines with manual operation the last step should be extended to approximately ten minutes for the clothes

to retain the starch. Machines without manual operation, such as Class 3 machines (PLC), may require additional starch in order to achieve the desired stiffness. Always accomplish the sizing operation at the low water level at approximately 120°F.

NOTE

To prevent starch from settling on top of the load as the water in the machine drains away, starch should be drained while the washer is still running.

655-4.1.4.2 Starching usually is done in the washer; occasionally, however, small loads or a few pieces of laundry can be hand-dipped in a separate container. The amount of starch required depends upon the amount of stiffness desired in a load or article and the amount recommended by the formula used.

655-4.1.4.3 At one time, white and colored shirts were starched separately, but experience has shown that they can be starched together satisfactorily. Following is the procedure for starching shirts in the washer.

655-4.1.4.4 If it is desired to remove starch from the bodies of shirts, raise the water level at the end of the starch run to eight or 10 inches, and then dump it immediately. The collars and cuffs, since they have two or more layers of material, will retain the starch. This process can only be accomplished in machines with manual mode since an final manual extract is required.

655-4.1.5 Dry cleaning solvent is a synthetic solvent, known as perchloroethylene or "perc" and is specifically made for cleaning clothes in a dry cleaning plant. It is the sole liquid used in dry cleaning machines for garment cleaning purposes, and should only be used when it is free and clear of water, dirt, rust, oils, or other contaminants.

655-4.1.5.1 Due to the dangerous toxic properties of this solvent, safety and health hazards exist, and caution should be fully exercised when handling containers of this solvent, and when operating the dry cleaning machines. Proper safety equipment should be worn, such as eye goggles, gloves, apron, boots and breathing respirator. The dry cleaning machines should be frequently checked to ensure that dry cleaning solvent vapors are not escaping into the atmosphere. Special attention when checking the machines should be given to door gaskets, door fan, pipe fittings, lint bag, button trap, filter cartridge covers, and the ventilation system which is interlocked to the machine.

655-4.2 SUPPLIES

655-4.2.1 All detergents, builders, bleaches, and other supplies and equipment necessary for the complete functioning of shipboard laundries are generally available through NEXCOM 1-M contracts from local suppliers.

655-4.2.2 Information concerning washing formulas and quantities of supplies required are in **Ship's Serviceman Laundry Handbook**, 1976, NAVEDTRA 10293 or available from the local NEXCOM Fleet Operational Assistance Team.

655-4.3 CONSERVATION

655-4.3.1 It is important that efforts be made to conserve chemicals and supplies by using proper amounts, and no more, to obtain high quality work. The use of excessive amounts of supplies results in waste and decreases the quality of the work done.

REAR SECTION

NOTE

TECHNICAL MANUAL DEFICIENCY/EVALUATION EVALUATION
REPORT (TMDER) Forms can be found at the bottom of the CD list of books.
Click on the TMDER form to display the form.

